Societal Impacts

We’ll focus on analyzing the impacts of technology …

- That is, instead of telling you what the impacts are
- We’ll look at “tools” to help you analyze the impacts
Recall: **Values** … what you believe to be “good”

**Questions**

- Does technology impart certain values?
- Does software impart certain values?

**Two Extremes ...**

1. **Technological Neutrality**
   - A technology is just a tool
     - e.g., for greater efficiency
   - Technology is indifferent / neutral to values
     - e.g., values arise from how it is used
Two Extremes ...

2. Technological Determinism

- Tech. progress has its own “life” (plays itself out)
  - Corollary: Humans powerless in the face of technology
- Tech. development is external to and controlling of societies

Two Extremes … Neutrality vs Determinism

Q: What is the problem with these two extremes?

- Both allow an alibi for separating technology & values
  - either unrelated to values (neutrality) …
  - … or can’t control where it goes anyway (determinism)
- Provide an excuse for not doing anything

Interesting related discussion on VR and AI:
An Alternative View

The Technical Code “... the values and (cultural) assumptions that become manifest in a technology / technology design”

1. Explicit values and assumptions
   - E.g., based directly on the design features

2. Implicit values and assumptions (may be unintentional)

As technology becomes used …
   - The design (technical code) becomes “locked in”
   - Influencing future thought and behavior

Exercise

Q: What is the technical code for …

   (implicit & explicit values/assumptions of design)

Smartphones?
   - some implicit assumptions: always reachable, connected, interruptible

Internet?
   - Some implicit assumptions: openness, diversity of speech, hard to maintain privacy
Four things to consider when analyzing impacts

1. What is the technical code?

2. What societal changes are created?
   - **way of life**: how we live, work, play and daily interactions
   - **culture**: shared beliefs, customs, values
   - **community**: cohesion, stability, character, services, facilities
   - **politics**: participation, access/influence, democratisation
   - **environment**: availability/quality of food, air, water, exposure to hazards
   - **health**: physical, mental, social and spiritual well-being
   - **economics**: personal/property rights, disadvantage, wealth, equality
   - **fears & aspirations**: perceptions about safety, future of your community, aspirations for your future & children’s future

3. Who is impacted by the technology?

4. What are positive & negative impacts & their trade-offs?
Four things to consider when analyzing impacts

3. Who is impacted by the technology?
   - e.g., individuals, entire organizations, parts of society
   - are impacts local, regional, national, global
   - to what degree is each impacted

Four things to consider when analyzing impacts

4. What are positive & negative impacts & their trade-offs?
   - e.g., openness of internet versus lack (difficulty) of privacy
Exercise Moral Imagination

**Ethical habits of mind and action**

- Recognize personal & professional choices have consequences for the lives of others (good & bad)
- **Employ empathy**: really imagine what it will be like for others (pain caused, benefit brought)
  - especially those outside our personal circles & daily view
  - expand your understanding (news, books, films, conversations, ...) about human condition to help better envision lives of others
  - Make a habit of envisioning the likely impact on others

Reflect on your own project in your team …

⇒ Q: How have you employed empathy in your design?
⇒ Q: How could you better employ empathy moving forward?
⇒ Q: How might this impact your design choices?
What is meant by “lifelong learning”

- Learning on your own (or how to learn on your own)
- Effectively using continuing education to maintain/develop technical currency

Q: Why is lifelong learning important in Computer Science?
Professional Development & Lifelong Learning

Why?

● Professional obligation to stay current
● Software development changes rapidly
● New projects often require new skills
● Many projects also require non-CS skills (user needs)
● Because you are interested / have a desire to learn

A process for learning … Identify:

1. Reason for learning … for project, self, etc.
2. Extent of learning … how deep / how much?
3. Resources to use … many options
4. Assessment of learning … “done” criteria
5. Process improvement … reflection

Q: Come up with a scenario for the process based on senior design
Q: What resources (sources of information) have you used to “learn on your own” so far for your senior design project?

Not all sources of information are equally “authoritative”

- “An authoritative source is a work known to be reliable because its authority or authenticity is widely recognized by experts in the field”
- Implies need to verify authorship and/or content
- E.g., on Wikipedia it is difficulty to verify authorship and hard to determine if authors have authority in the subject

Q: What should “reliable” entail for software engineering?
Q: For each resource you identified, determine if it was a “good” source of information (i.e., what level was it authoritative/reliable)

Some additional/typical software engineering resources:

1. Graduate school (Masters, Ph.D.)
2. Certificate programs (somewhat controversial)
3. MOOCs (e.g., Coursera, OpenCourseWare, EdX, Udacity, Udemy, Khan Academy, ...)
4. Seminars/Short Courses (e.g., 1 to 5 day intensives)
5. Technical conferences (Google I/O, JavaOne, PyCon, O’Reilly, ...)
6. Books (tons of technical books)
7. Online Tutorials (many of these as well)
8. *Side projects* (often best for technical skills ...)*
1. Cultivate lifelong learning as a “Style of Thinking” that concentrates on fundamental principles over facts
   - look for principles, fundamentals, and patterns
   - facts are important only so far as they lead to principles

2. Structure your learning to ride the information tsunami rather than drown in it
   - total amount of knowledge has doubled about every 17 years since Isaac Newton (1643-1727)
   - half-life of technical knowledge estimated at 15 years
   - if $x$ is the amount of knowledge available today, then $2x$ in 15 years with $0.5x$ obsolete, thus from $x$ to $1.5x$
   - need to structure our learning to not get buried in information (... be structured, not haphazard)
3. Be prepared to compete and interact with a greater and more rapidly increasing number of scientists than at any time in the past
   ● e.g., 90% of the scientists who ever lived are alive today

4. Focus on the future but don’t ignore the past
   ● prepare for the future when it comes
   ● don’t reinvent what has already been done

5. Look for the personal angle
   ● helps to know why certain technology or approaches exist, and to remember them
Ten Simple Rules for Lifelong Learning (R. Hamming)

6. Learn from the success of others
   - “there are so many ways of being wrong and so few of being right, studying successes is more efficient, and furthermore, when your turn comes you will know how to succeed rather than how to fail”
   - “vicarious learning from the experiences of others saves making errors yourself”

Ten Simple Rules for Lifelong Learning (R. Hamming)

7. Use trial and error to find the style of learning that best suits you
   - Learning how to learn is like learning how to paint …
   - one learns by trying many different approaches that seem to surround the subject

8. No matter how much advice you get and how much talent you possess, it is still you who must do the learning and put in the time
Ten Simple Rules for Lifelong Learning (R. Hamming)

9. **Have a vision to give you a general direction**
   - be economical and structure your efforts according to the general direction in which you want/need to move
   - “having a vision is what tends to separate the leaders from the followers”

Ten Simple Rules for Lifelong Learning (R. Hamming)

10. **Make your life count: Struggle for excellence**
    - “the life of trying to achieve excellence in some area is in itself a worthy goal for your life ...”
    - “a life without such a goal is not really living but is merely existing”