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**Challenging Democracy: Science and Public Trust**

# Anticipatory Governance of Science and Technology: Challenges to Democracy

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# Overview

1. Introduction
   - Science and technology in society: challenges to democracy?
2. Governance of new and emerging technologies
   - Established capacities of anticipatory governance?
3. Approaches to anticipatory governance
   - Varieties of Technology Assessment (TA)
4. Conclusion and outlook
   - Challenges, opportunities, and limits; Extensions

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# 1. Introduction

- Science and technology (S&T) in society: challenges to democracy?
  - New and emerging S&T
    - Dynamic forces shaping present and future society
    - Subject to democratic control?
    - Role of S&T in democratic societies?
  - Social change
    - Disruptive?
    - Winners and losers?
    - Power in decision-making?
  - Anticipatory governance
    - Aims at contributing to social shaping of technologies—i.e., future significance of S&T in society
    - Governance capacities within and outside democratic institutions?

## 2. Governance of S&T

- Challenges
  - *Temporal:* time horizons; significance of developments in S&T
  - *Material:* realization of potentials of S&T; context-specific usefulness; intended and unintended consequences
  - *Social:* divergent interests and preferences; multiple institutional and organizational contexts
- Approaches
  - Foresight
  - TA
  - Participation
- Limits
  - Dynamics and non-linearity of technological and social change
  - Plasticity of technological applications and institutional contexts
  - Divergent user preferences and concerns

→ Anticipation of future is necessary, but there are inherent uncertainties, indeterminacies, and ambiguities

- Established capacities of anticipatory governance
  - *Innovation:* foresight, e.g., monitoring, roadmapping, scenarios (as exercised by government, industry, and think tanks, etc.)
  - *Risk management:* prevention and precaution as regulatory principles, e.g., moratoria, international agreements
  - *Patenting:* legal entitlements granted to inventors with regard to future applications, while securing systemic innovativeness
  - *Ethics:* norms to guide decision-making, and sanctions, towards morally sensitive or dubious options of action, e.g., laws, guidelines, declarations
  - *Acceptance politics:* shaping contemporary perceptions of future possibilities

→ Anticipatory capacities embedded in established modes of governing S&T, concerning the generation, regulation and enculturation of S&T

# 3. TA and anticipatory governance

- Multiple approaches to TA have been developed since 1960s, in a variety of institutional domains (e.g., parliaments, companies, academia), e.g., conceptualized as “early warning systems”
- Core ideas: TA should
  - Be conducted as early as possible
  - Be closely related with research and development
  - Provide multiple perspectives
- Recent fields of TA experimentation to close/narrow gap to S&T:
  - Human Genome Project/Genomics
  - Nanotechnology
- Approaches:
  - Research on Ethical, Legal, and Social Issues (ELSI)
  - Constructive TA (CTA; NL), Real-Time TA (RTTA; USA), Upstream Engagement (UK)

- RTTA at Arizona State University
  - Organizational features, Center for Nanotechnology in Society:
    - Funded by U.S. National Science Foundation
    - Based on political mandate, i.e., 21st Century Nanotechnology R&D Act of 2003 (Public Law 108-153)
    - Operating as inter-university network (e.g., Georgia Tech, UW-Madison, NC State U)
    - Organized in four RTTA areas and two thematic research clusters, plus teaching and outreach
  - Capacity building for anticipatory governance:
    - *Foresight:* generating anticipatory knowledge
    - *Integration* of knowledge across academic cultures: science and engineering, humanities and social sciences
    - *Engagement:* participatory exercises providing input by citizens and publics, face-to-face and online

- Aspects characterizing operating mode of CNS-ASU:
  - Key role of scientists and engineers:
    - *Collaboration* (research, teaching)
    - *Advising and consulting* (e.g., issues requiring S&T expertise)
    - *Serving as research subjects* (e.g., discussing research-related decisions and potential impacts of nanotechnology)
  - Partial reconfiguration of social relationships:
    - In academic research and development
    - Between technology development and society

[see Barben, Fisher, Selin & Guston 2008, in *Handbook of Science & Technology Studies, Third Edition,* MIT Press, Cambridge MA, pp. 979-1000]

# 4. Conclusion and outlook

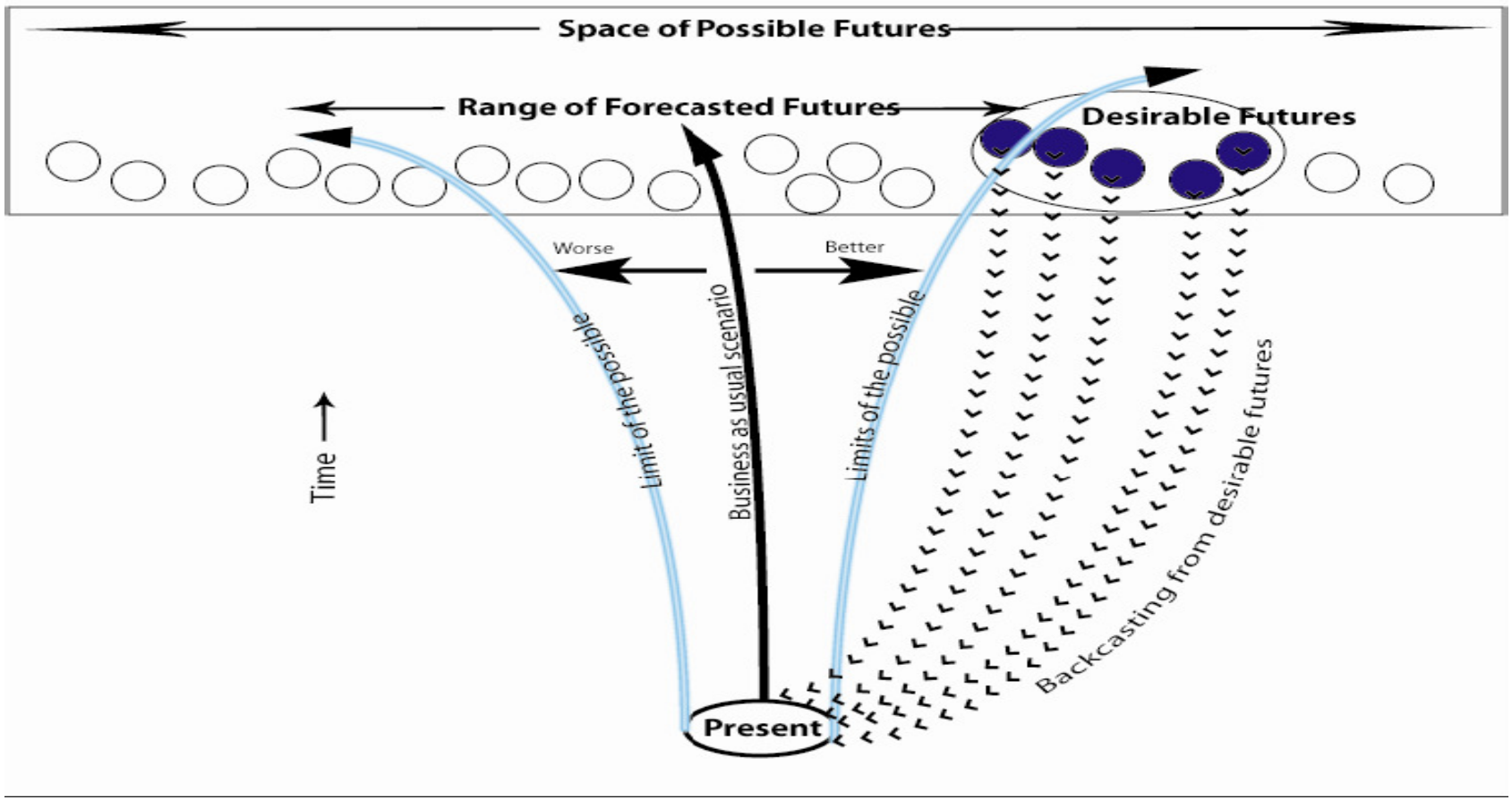


*Fig.: Opportunity spaces for anticipatory governance of S&T*

- Challenges to TA:
  - Further institutionalization of TA is needed, requiring political will, funding, and implementation in public and private settings
  - Learning by all participants involved
- Opportunities:
  - Improved technologies (e.g., development, outcomes)
  - Improved societal embedding (as regards conditions of application and user preferences)
- Limits:
  - Capacities to shape later stages of technology development
  - Regulatory capacities (e.g., patenting, risk management, ethics)
  - Feedback mechanisms to institutions of democratic, and corporate, decision-making

- Extensions of anticipatory governance required:
  - Institutional change, to expand anticipatory governance at local, national, and international levels—in order to better account for and shape future uncertainties and outcomes
  - Reflexive governance, i.e., capacity to take into account in one's decision-making the characteristics of particular domains of practice
  - Future-oriented transformation of infrastructures (e.g., energy, building, mobility, water, waste, urban & spatial development)
  - Geoengineering, an emerging approach to fight global warming that lacks democratic governance and global legitimacy
  - Future-oriented adaptation of democratic institutions, including expansion of direct democracy