

HEALTH INFORMATICS, SOCIO-TECHNICAL THEORY, AND SOCIO-TECHNICAL SYSTEMS: INTERACTIONS AND CHALLENGES

SOCIO-TECHNICAL THEORY

Definition

According to Abbas and Michael (2023), socio-technical theory (STT)

- Is an organizational theory that interprets a work or other system as composed of its social and technical subsystems.
- Aim to achieve system success through collective.

Description

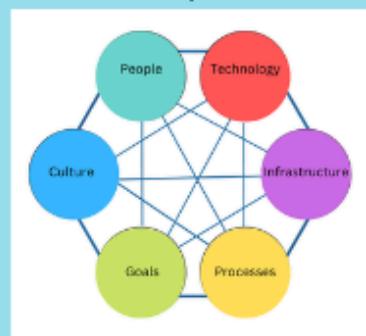
According to Kaminski (2022),

- This theory proposed that both technology and people should be seen as synergistic aspects of an interwoven system.
- Humans worked best as a system of intelligent agents capable of innovation and making sound decisions to improve the workflow and processes.

Use in Health Informatics

Significant uses of this theory in Health Informatics (HI) are (Kaminski, 2022):

- User-Based Design. Socio-technical theory stresses involving clinicians when developing health IT solutions. That collaboration keeps the systems simple and user-friendly.
- Recognizing Adoption and Opposition. The theory allows to understand more why some stakeholders are opposed to new technologies. It highlights the need to marry social norms with technical capabilities for easier adoption.



SOCIO-TECHNICAL SYSTEMS

Definition

According to Abbas & Michael (2023) socio-technical systems (STS):

- Are systems in which social and technical components are integrated within an entity, whether an organization, society or technological system.
- Acknowledge the interdependence between humans (social system) and technological (technical system) and point to the need for mutual optimality to achieve efficiency and human satisfaction.

Description

According to Abbas & Michael (2023) socio-technical systems:

- Describe an organization or landscape's social and technical interrelatedness.
- Emphasize designing and implementing human (social) and technical aspects to be as efficient, effective, and gratifying as possible.
- People, roles, relationships, culture, and organizational systems are the elements of a social system.
- Technics include machines, tools, technologies, and tasks themselves.

Use in Health Informatics

Socio-technical systems contribute to HI by (Gordon & Ian, 2011; Kemp et al., 2023):

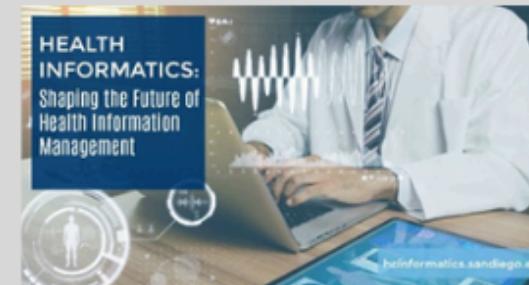
- Providing a model to analyze and optimize the interaction between healthcare technology, personnel, and organizational structures.
- Ensuring that health information technologies are used in ways that are compatible with the social networks involved in healthcare provision.
- Designing and implementing health information systems.
- Integrating technology into clinical workflows.
- Improving patient safety and reducing errors.
- Facilitating interoperability and collaboration among healthcare providers.



RELATION BETWEEN MANAGEMENT, HEALTH INFORMATICS, SOCIO-TECHNICAL THOERY AND SYSTEMS

Management and Health Informatics

- In HI, management refers to methods and practices for managing information technology systems development, deployment, and use within healthcare facilities (Sherifi et al., n.d.).
- The aim is to streamline data collection, management, reporting, and analysis for better patient care and more efficient healthcare processes (Sherifi et al., n.d.).
- Essentially, it involves the governance of IT and data infrastructure to aid in clinical decision-making and delivering high-quality care (Sherifi et al., n.d.).
- This interplay covers many domains such as Planning and Execution, Change Management, Data Governance and Compliance, Performance Monitoring and Quality Improvement (Zeng et al., 2009; Bouvé Communications, 2023; Cornwell, 2024).



Relation between Management, Socio-technical theory and systems

- Management involves STT and STS, emphasizing the need for a careful balance between an organization's social and technical aspects when making and implementing decisions. This balancing act is crucial for how organizations plan, implement, and operate their STS.
- The socio-technical theory recognizes that humans and technology should work together to achieve optimal results, rather than prioritizing technical efficiency at the expense of human interaction. It suggests that the social and technical subsystems within organizations are interconnected. Therefore, it is management's responsibility to coordinate these subsystems to ensure they function optimally (University of Leeds, n.d.).

RELATION BETWEEN HEALTH, CLINICAL CARE, HEALTH INFORMATICS, SOCIO-TECHNICAL THOERY AND SYSTEMS

Health, Clinical care and Health Informatics

There is a relationship between health, clinical care, and HI, as HI (Berner, 2009; Sittig & Singh, 2012; Bouvé Communications, 2023):

- Integrates information technology and data into healthcare, bridging the medical and clinical delivery systems.
- Strives to deploy technologies and processes that enhance quality and safety of healthcare.
- Helps create and deliver Clinical Decision Support Systems that allow providers to make informed choices.
- Improves patient care by ensuring timely access to patient data, minimizing mistakes and making clinical decisions.
- Facilitates remote consultation of patients through mobile medical apps.
- Enables the monitoring of public health trends to target disease interventions.
- Is at the heart of modern clinical practice because it unites health information and delivers care data.
- Data analysis in informatics detects the social determinants of health and assesses health policy.
- Both clinical care and HI ultimately seek to improve health.



Health, Clinical care, Socio-technical Theory and Systems

There is a relationship between health, clinical care, Socio-technical theory and systems (Trist & Bamforth, 1951; Clegg, 2000; Caravon, 2006; Sittig & Singh, 2010; Waterson, 2014), as

- STS focus on making medical care technologies, including EHRs and diagnostic tools, accessible in the clinic.
- STT focus on human-centric systems design so that healthcare providers can interact with technology effectively.
- STS strive to enhance patient-centered care through social elements, like cultural sensitivity, complemented by technical tools, like telehealth.
- STS and STT help create resilient systems to adapt to new threats.
- These theories emphasize the need to discover and mitigate risk in clinical care systems by studying how people, processes, and technology interact.
- STS focus on making medical care technologies, including EHRs and diagnostic tools, accessible in the clinic.

Ergonomics and Health Informatics

There is a relationship between ergonomics and HI (Carayon, 2006; Hedge, 2010; Kushniruk & Patel, 2014), as:

- Ergonomics optimizes health informatics by addressing human-driven system use.
- Ergonomics helps HI solutions provide better patient and provider outcomes by, prioritizing usability, safety, and comfort.
- Ergonomics aids in developing easy-to-use interfaces to EHRs and other applications that help ease the mental and physical burden of care practitioners.
- The incorporation of ergonomics into informatics systems can also minimize data entry errors and ensure the accuracy of clinical judgments.
- Ergonomics also makes it easier for clinicians and patients to use telemedicine tools by accommodating the entire spectrum of user requirements and eliminating barriers to accessibility.
- Ergonomics can be incorporated into health informatics system training to facilitate adaptation and mitigate resistance to change.



Ergonomics and Socio-technical theory and systems

Principal relationships between ergonomics and STT and STS include several key points (Carayon, 2016; Hendrick & Kleiner, 2002; Mumford, 2000; Vicente, 2004):

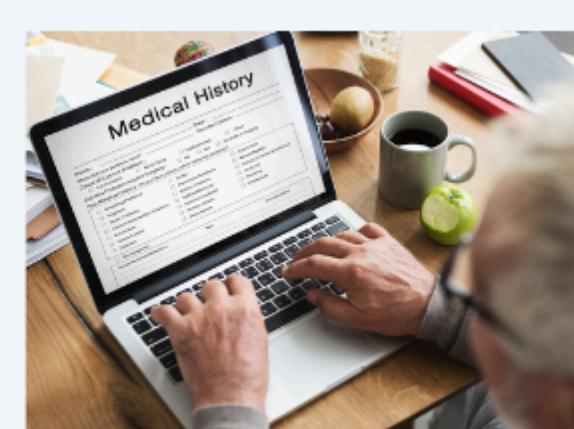
- Both focus on how humans interact with various system components to enhance performance, safety, and efficiency.
- Both support human-centered design, which ensures that users are part of the design process so that systems serve their needs.
- Both seek to minimize error and danger by implementing intuitive, resilient designs.
- STS and STT highlight the interconnectedness of social and technical subsystems within an organization. Ergonomics complements this by studying how technology affects human interaction and developing systems that are easy to use and less stressful.
- Where STT takes up risks inherent to social-technical interaction, ergonomics solves them by designing systems that minimize human error and enhance safety.
- STS incorporate cognitive ergonomics by designing systems that support human thinking processes and reduce cognitive load.

RELATION BETWEEN PERSONAL RECORDS, HEALTH INFORMATICS, SOCIO-TECHNICAL THEORY AND SYSTEMS

Personal Health Records and Health Informatics

Below is how Personal Health Record (PHRs) are related to Health Informatics (Archer, 2011; Park et Yoon, 2020; Ruhi & Chugh, 2021; Hosseini, 2023; Davis et al., 2024):

- PHRs are health informatics – tools to support patient engagement and data-driven care. They practice patient-centered care by enabling individuals to participate in their care.
- Health informatics allows PHRs to connect with EHR systems, facilitating the easy exchange of data between patients and providers.
- PHRs serve as a communication hub between patients and healthcare professionals, one of the fundamental principles of health informatics.
- HI implements standards like FHIR (Fast Healthcare Interoperability Resources) to protect, secure, and make PHRs available.
- Accessed via HI platforms, PHRs also encourage preventative medicine, enabling users to program alerts for screenings, vaccinations, and medications.



Personal Health Records, Socio-technical Theory and Systems

The relationship between PHRs, STT and STS is that technology, people, and processes interact in healthcare contexts. Here is an explanation (Berg 1999; Kushniruk & Pate, 2004; Bates & Bitton, 2010; Greenhalgh & Stones, 2010):

- PHRs are socio-technical systems that blend technical aspects (software, interfaces, data privacy) with social aspects, such as patient engagement and interprofessional collaboration.
- STT recommends focusing on user needs when designing PHRs. This includes making it intuitive for patients with various levels of health literacy and technical know-how.
- Social factors, like patient confidence in data privacy and security, determine the success of Personal Health Records.
- STT emphasizes the easy integration with EHRs and other healthcare platforms for patient-provider communication.

CHALLENGES WITHIN SOCIO-TECHNICAL SYSTEMS AND HEALTH COMPUTING

How Management contributes to hinder the functionality and usage within Socio-technical Systems and Health Computing

Some keyways that management may hinder Socio-technical Systems and health computing include (Whetton & Georgiou, 2010; Gaskin et al., 2011; Pasmore et al., 2018), but are not limited to:

- **Inadequate User Participation.** Suppose management lacks a commitment to involving end-users in designing and deploying new systems. In that case, it leads to wasteful systems that are neither workable nor adaptable to the current workflow.
- **Overemphasis on Technology.** Focusing on technological solutions instead of social ones will dislodge users and delay adoption.
- **Lack of Change Management, Training, and Support.** Uncontrollable changes to the new systems lead to communication breakdowns, low morale, and decreased effectiveness.
- **Poor Communication and Coordination.** This can lead to scattered goals and disorganized system adoptions that kill the productivity of socio-technical systems.

How health and clinical care can hinder the functionality and usage within socio-technical systems and health computing

Some ways health and clinical care can create challenges in socio-technical systems and health computing include (Ash et al., 2004; Walker et al., 2005; Lapointe & Rivard, 2005):

- **Resistance to Change and Adoption.** Healthcare workers often hesitate to switch to new technologies because they feel they are complicated, fear adding more work, or are unfamiliar with the technology. This resistance can prevent healthcare computing tools like EHRs and decision support systems from being used. It constrains their use and diminishes the usefulness of technology in the clinical setting as a whole.
- **Workflow Misalignment.** Workflow alignment issues with health computing systems create inefficiencies and user frustration. Without clinical alignment, these workflows can disrupt patient care, burden resources, and reduce trust in technology.
- **Interoperability Barriers.** Poor system integration and interoperability stall data flow across platforms and enterprises. Poor interoperability can lead to fragmented care, data silos, and

How Personal Health Records can hinder the functionality and usage within socio-technical systems and health computing.

Many socio-technical barriers could hinder the utilization of personal health records in health computing environments. Below are some key challenges (Gaskin, 2011; Burgess, 2024):

- **Security and Privacy Issues.** Digital data storage brings serious security risks. Unauthorized access, data leaks, and the misuse of health data are all just as common.
- **Interoperability Issues.** Without standardization, it is not easy to find and share PHRs between providers. Eliminating these networks creates uncompleted histories and disproportionate treatment coordination.
- **Digital Literacy and User Engagement Issues.** Studies have shown that user experience and social/cultural issues are significant barriers to the adoption and use of PHRs.

How ergonomics can hinder the functionality and usage within socio-technical systems and health computing

Some ways ergonomics can create challenges in socio-technical systems and health computing include (Vicente, 2004; Sittig & Singh, 2010; Norman, 2013; Caravon, 2016).

- **Oversimplification of Systems.** In an oversimplified system, engineers try to reduce interfaces and workflows, so they are easier to navigate; however, a missing element in these systems is losing vital capabilities.
- **Dissonance Between Design and Users.** Ergonomic designs rarely account for the plurality of users, particularly in socio-technical systems where people belong to different professions and backgrounds.
- **Ignoring Workflow Complexity.** It is tempting to focus on physical and mental ergonomics without regard for the intricacies of socio-technical processes. For example, automating part of health computing for cost-saving reasons might inevitably interrupt working relationships between physicians.

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