Distributed Cognition: Interactions Between Individuals and Artifacts

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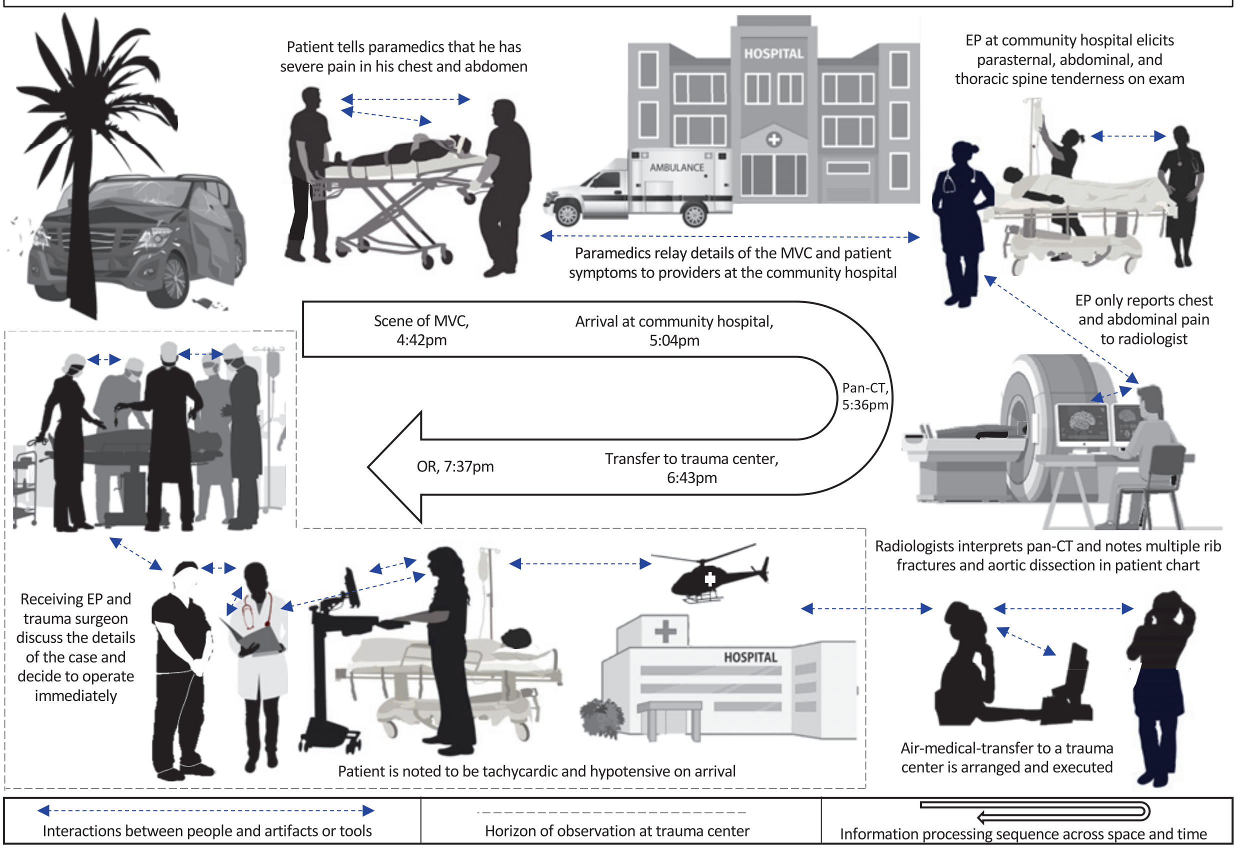
In *distributed cognition,* bidirectional interactions between *individuals* and *artifacts* (i.e., medical charts, computers, imaging technology) facilitate medical decision making. Because cognition is dispersed among team members and their work tools, the system has greater capacity for developing complex diagnostic and treatment plans. Additionally, the distributed nature of cognitive processes allows information to be accessed and modified by multiple individuals, teams, and information systems across space and time. However, access to certain elements of the distributed cognitive system can also be limited by an individual's *horizon of observation*; that is, their ability to directly interact with specific providers and patients, access to clinical notes and records, and testing data such as imaging.

Example: A 25-year-old male is brought to a local hospital after a motor vehicle collision (MVC) in which he was the unrestrained driver. The paramedics report significant vehicle damage and a prolonged extraction. He is complaining of severe chest and abdominal pain and has parasternal, abdominal and thoracic spine tenderness on initial exam. The emergency physician (EP) obtains a pan-CT. The radiologist notes multiple rib fractures and an aortic dissection. The EP arranges air-medical transfer to a trauma center. The chart, but not the original images, are sent with the patient. On arrival at the trauma center, the patient is tachycardic and hypotensive. The receiving EP discusses the case with the trauma surgeon, and the patient is rushed to an operating room (OR). Post-operatively, the patient is paraplegic and a T7 burst fracture is found.



In this example, a distributed cognitive network (DCN) is created as individual healthcare workers (i.e., paramedics, EPs, radiologist, trauma surgeon) gather historical (i.e., chest and abdominal pain), physical (i.e., parasternal, abdominal, and thoracic spine tenderness), and imaging (i.e., pan-CT) data that is exchanged via team interactions and/or externally represented through artifacts (i.e. patient chart, CT images). Individual providers can expand the DCN by documenting their impressions (i.e., radiologist dictates multiple rib fractures and traumatic aortic dissection in patient's chart) or verbalizing their thoughts with others (i.e., EP reports chest and abdominal pain, but fails to mention thoracic spine tenderness to the radiologist). Ultimately, details from the scene of the MVC provided by the paramedics, signs and symptoms noted by the EP at the community hospital, and the radiologist's interpretation of the pan-CT are communicated to the receiving EP and surgeon at the trauma center. The boundaries of the DCN span space and time, enhancing the ability of providers at the trauma center to act. However, because the CT images were not delivered to the trauma center, the providers develop a treatment plan based on the radiologist's note in the chart. Their limited *horizon of observation* (i.e., inability to view CT images) causes them to miss the T7 burst fracture until they note his paraplegia post-operatively.

References: 1) Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: The MIT Press.

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