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Managing Information Flow on Complex Projects

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The Importance of Information Flow Management in Construction

New design paradigms, innovative product, technologies, and processes – All of these factors have exponentially increased the amount of information that professionals in the construction industry need to process. Despite the increased amount of information available to projects, the majority of the information shared by project teams never ends up actually adding value to the project. This is especially true for complex projects that stand the most to gain from incorporating new information. The major reason for this waste of information stems from ineffective information flow management. This report is a summary of the constructs that emerged from research involving the social factors affecting information flow and integration on complex healthcare projects.

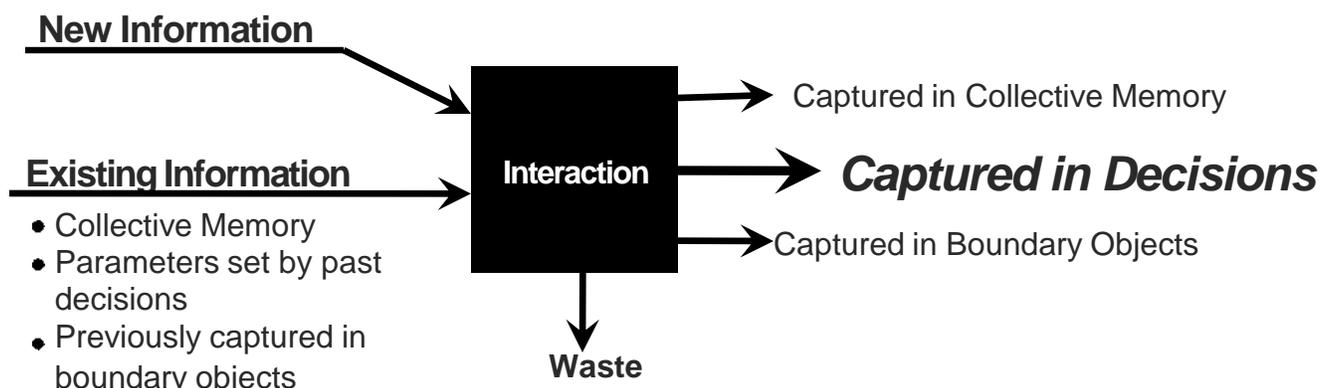
What Happens to Information?

Information flow, just as any other type of flow, requires four components: a starting point (source), an ending point (receiver), a path (interaction), and a driving force (mutual relevance). There are two types of entities that can serve as sources or receivers of information: 1) people and 2) boundary objects (i.e. tools such as drawings, reports, building information models, requests for information, and other documents that enable communication between groups of people).

A person's role in information flow is determined by their contractual role, their informal technical role, and their social role within the project. These roles determine the types of information that are expected from a person, the type of information that the person can contribute, how that information is shared, and how it is received. Boundary objects affect information flow through their structure which influences the types of information, richness of information, and the process for capturing and using information.

While the characteristics of the people and object involved with a project set up the potential for information flow, it does not guarantee that the available information will actually be incorporated into the project. It is the interaction between these entities that ends up determining the fate of information. Based on types of interactions, information can either be accepted, rejected, or ignored.

In order for information to add value to a project, there are three critical steps that need to take place. First, information needs to be shared by an individual on the project team. Second, the shared information needs to be accepted by others on the project team. Information that is ignored or rejected becomes waste and essentially disappears from the project unless shared again under different circumstances. Information that is accepted by others is captured tacitly in the collective memory of the project team and can be captured explicitly in boundary objects. However, acceptance of information does not actually add value to a project. It is only when that information has been captured in a decision, that it finally is able to add value to the project, and 3) into the project, it needs to first of all be shared by a project team member and made available.

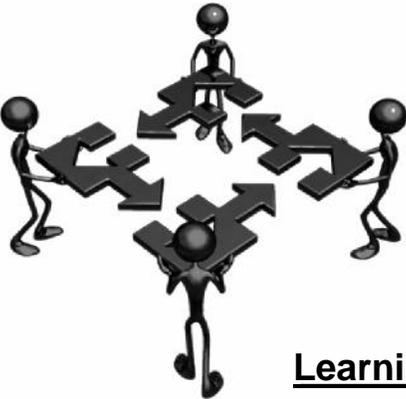


Whether information becomes waste, is captured tacitly or explicitly, or captured in a decision makes a great deal of difference to the project. Therefore, understanding what happens within the “black box” of interaction is critical to improving information flow and the overall quality of complex projects.

Understanding Interactions: Understanding What is Inside the “Black Box”

The “Big Four” Moderators of Interactions

Throughout this research, there were a number of moderating factors that affected the outcome of interactions. At a fundamental level, all of these moderators came down to four major interrelated factors: Trust, commitment, learning, and common understanding. These key factors determine what information and individual shares, how they share it, how it is received, and sets the stage for future interactions.



Trust & Commitment

- *Trust* involves having positive expectations about another’s future actions when an individual is vulnerable to those actions.
- *Commitment* is the strength of an individual’s identification with and involvement in a particular organization.

Together these constructs affect a persons values regarding the project, such as: 1) how they view others in the project team, 2) how they view their own role in the project, 3) how much effort they are willing to put forward, and 4) their sense of association and interest in the project.

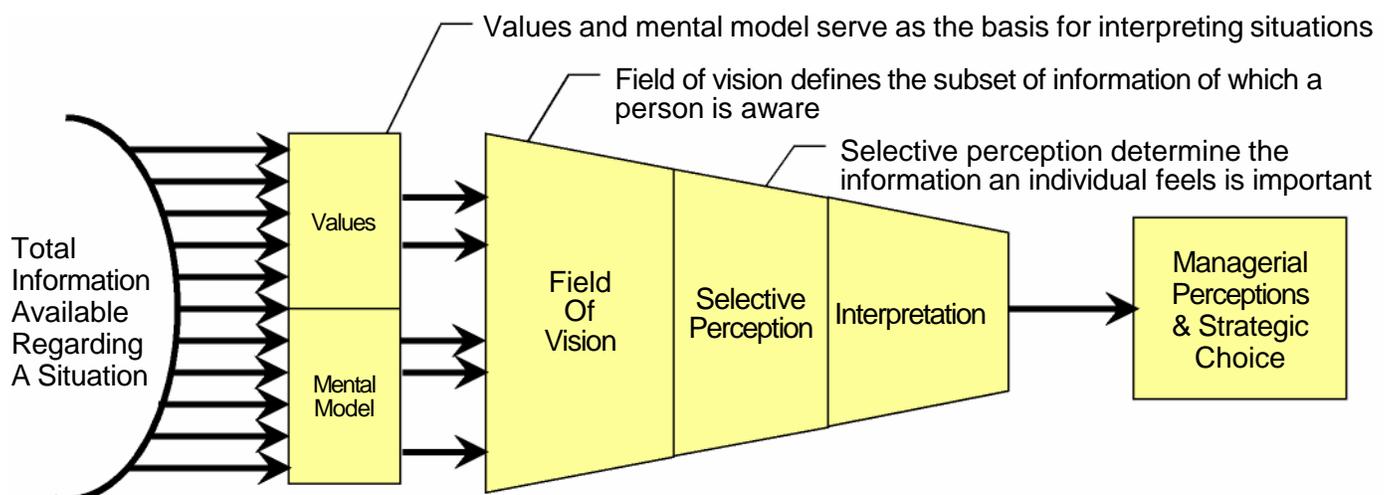
Learning & Common Understanding

- *Learning* occurs when processing new information changes an individual’s range of potential behaviors.
- *Common understanding* comes from an informal agreement regarding what is relevant to other team members and the project in general.

Together learning and common understanding form an individual’s mental model. Mental models determine how a person: 1) evaluates new information, 2) links new information to their existing knowledge, and 3) categorizes and orders information for the project.

Values, Mental Models, and Decision Making

People are rationally bounded; i.e. we are only capable of understanding a limited amount of information. Therefore, we rely on our values and mental model (i.e. frame of reference) to limit the amount of information that we need to process. Based on their frame of reference, people only become aware of a subset of the total information available. From that information, they further filter information based on what they feel is important. The remaining information is what they use to interpret the situation and make decisions. Because of differing frames of reference, different individuals can be exposed to the same situation and the same information and derive very different ideas about the best course of action.



Model of Strategic Choice Under Conditions of Bounded Rationality

(Hambrick and Mason, 1984)

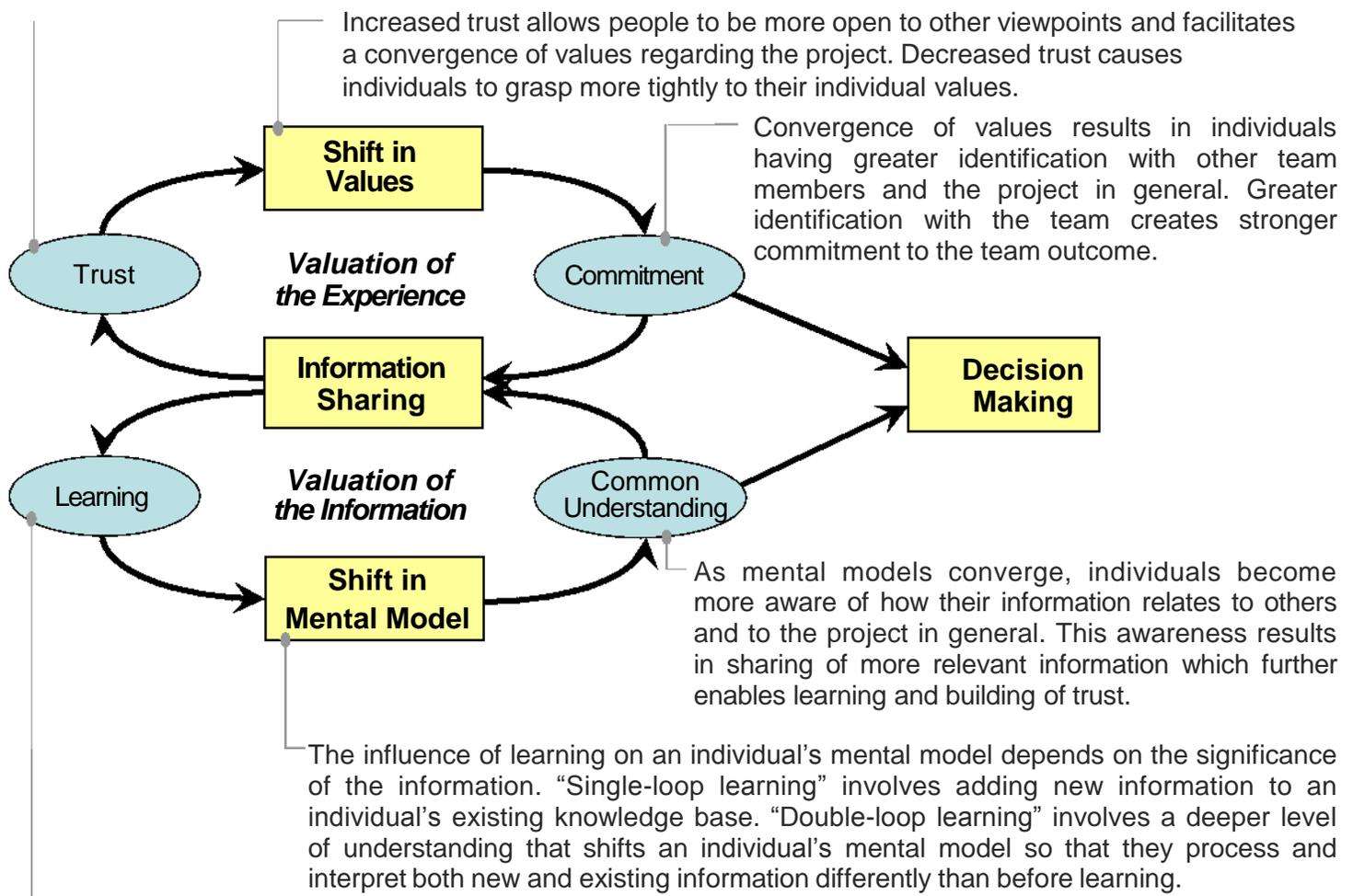
Improving Information Flow Effectiveness Through Converging Values and Mental Models

The Unrealized Outcomes of Project Team Interactions

The main purpose of project team interactions is to share information and make decisions. In addition to discernible outcomes (e.g. decisions, revised documents, action plans, etc), there are also outcomes that, although seldom realized, play a critical role in determining the effectiveness of subsequent interactions. These unrealized outcomes relate to how the people valued the experience (i.e. how they felt), and how they valued the information (i.e. what they learned). These valuations affect the amount, type, and quality of information shared in subsequent interactions, the interpersonal dynamic between team members, and the willingness of individuals to share and accept information. Throughout project delivery, there are countless interactions. As a result, interaction effectiveness becomes one of the most crucial factors in determining the outcome of a project. As individuals interact, there are two interrelated cycles that can either improve or adversely affect trust, learning, information flow effectiveness, and the eventual project outcome.

The Trust & Learning Cycles

How others share information or how a person's contributions are received affects the building of trust. These includes issues such as whether individuals feel: 1) Their contributions are valued by others; 2) They are being treated fairly; 3) There is mutual and individual accountability; 4) Their expectations are being met; and 5) Project team members show a commitment to team goals above their personal goals.



The characteristics of shared information determine its relative significance to others. Learning occurs when an individual thinks that information is significant and they internalize it within their own mental model. An individual's propensity to learn depends on: 1) Their willingness to learn; 2) The clarity and perceived quality of the information; 3) The relevance of the shared information to their existing mental model; and 4) An individual's trust of the person providing the information.

The Importance of the “Integrator” In Information Flow Management

Ambiguity: The Nemesis of Trust & Learning

The dynamic, information-intensive nature of the construction industry makes dealing with ambiguity a necessity. However, there is a hierarchy of ambiguity that requires that more fundamental issues be resolved before discussing more detailed concerns. In most projects, the majority of discussions revolve around debating the validity of a specific detailed issue, but these discussions carry unaddressed ambiguity about more fundamental issues such as project goals, the approach to realizing those goals, and the roles and responsibilities of each entity. Without clarifying these fundamental levels of ambiguity, discussions regarding detailed topics hit upon personal and value-based issues. While intellectual conflict and diversity of opinions are critical to providing quality information to the project, project teams

need to develop a common understanding with respect to goals, approach, and responsibilities to not negatively affect trust, commitment, willingness to learn, and the effectiveness of future interactions.



The Hierarchy Of Ambiguity

The Role of the “Integrator” in Information Flow Management

As construction projects become even more complex, the effective management and integration of information is central to the success of construction projects and the industry at large. Effective integration is necessary for incorporating research and innovation into projects and in leveraging the valuable experiential knowledge that exists in the people that make up our industry. Most importantly, integration is the catalyst that allows our industry to simultaneously specialize and integrate those specialties to create built environments that are much greater than just the sum of their parts.

The increasing importance of information management and integration requires an entity within project teams that is responsible for social and technical integration. The primary role of the integrator is to create an environment that facilitates positive trust and learning cycles. This includes: 1) Emphasizing the value of individual contributions with respect to the project goals; 2) Managing expectations by maintaining accountability, discipline, and fairness by establishing clear and consistent goals; and 3) Understanding the existing mental models of team members and providing links between them and the project.

In order for individuals to serve in this capacity, there is a need for skills and competencies that are not part of the traditional repertoire of construction management skills. These include developing:

- *Appropriate breadth and depth of technical knowledge* - an integrator needs to have a holistic understanding of the scope of work that they are integrating so that they can have substantive discussions with each specialist but also translate that information so that it is relevant to others.
- *Social awareness and emotional intelligence* - an integrator needs to be able to observe subtle signs of how team members are feeling and whether they understand relevant information so that they can take steps to adjust the current discussion and interpersonal dynamic to create a more favorable environment.
- *Expectation management* - an integrator needs to be able to effectively manage expectations to create the stable psychological environments required for higher level learning and the development of trust.
- *Strategic use of tools and techniques* - an integrator needs to be aware of how various tools and processes affect the facilitation of trust and learning so that they can be used strategically.
- *Planning and dynamic capabilities* - an integrator needs to be able to develop detailed and comprehensive plans, but also be able to quickly adapt their plan based on changing situations.

Additional Information

For much greater discussion related to these concepts and their practical applications, the full publication “**The Collective Potential: A Holistic Approach to Managing Information Flow in Collaborative Design and Construction Environments**” can be purchased through Amazon.com.