Knowledge plays a critical role for organizations, defining their structure, sustaining their performance, and driving their change. Given the importance of knowledge, we explore the following question: How does organizational knowledge evolve over time?

We take a network perspective of organizational knowledge. We assume that organizational knowledge consists of a network of interconnected knowledge nodes (e.g. routines, skills, stories, knowledge nodes) which are located in individual minds, organizational subunits, databases, organizational culture, artifacts, etc. Nodes are connected with each other through pathways of relevance, relatedness or referencing each other.

In this study, we trace learning to the level of individual nodes and examine how their ego networks shape their change. We build on notions of learning-as-knowledge-evolution and argue that ties between knowledge nodes expose a focal node to other nodes that hold knowledge with rules, laws), which are routines, skills, stories, knowledge nodes (e.g. clinical practice guidelines, guidelines, rules). In this sense, a knowledge network presents a context for change of individual rules.

Treatings rules as knowledge nodes, we formulate a model that describes how individual changes as a result of the characteristics of their ego networks. We argue that citation ties expose a cited rule to the application context of the citing rules and thereby to experience and problems that can offer learning opportunities and stimulate change of the cited rule.

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**Rule Networks and Rule Change**

Organizational rules function as dynamic repositories of organizational knowledge that retain fixed responses to recurrent situations. Change in knowledge can be accommodated through rule revisions that encode new knowledge into the rules.

Rules are often connected to other rules. Rules cite other rules governing related situations, e.g., to facilitate workflow coordination, task forwarding, etc. As a result, rules come to be embedded in rule networks that reflect the pattern of interdependencies in the rule system. We argue that this rule network presents a context for change of individual rules.

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**Alter Exposure (H1):** Rules with an inbound citation change faster than isolated rules.

- Being cited → Exposure to alters’ contexts → Being considered or applied in alters’ contexts → Performance gaps and problems → Intensified rule change

**Redundant Exposure (H2):** Rules connected to dense inbound networks change less than rules connected to sparse networks.

- Sparse network → Exposure to divergent or even contradicting impuluses → Many separate rule revisions
- Dense network → Exposure to redundant impuluses → Very few revisions

**New Exposure (H3):** New inbound ties intensify the change of rules.

- New inbound ties → Exposure to new contexts → New challenges for the cited rule → “Liability of newness” of the cited rule → Intensified impulses for change

**Knowledge Network and Knowledge Change: How Citation Ties Affect Rule Revisions**

Kejia Zhu & Martin Schulz

**Method**

Data: Longitudinal data of Clinical Practice Guidelines (CPGs) from 1995 to 2010, 799 CPGs, 1563 CPG versions.

**DV:** 1) External Revision: Probability of revision integrating external (healthcare research) knowledge, 2) Internal Revision: Probability of guideline revision integrating internal (healthcare practice setting) knowledge.

**IVs:** 1) Inbound network dummy at time $t$, 2) Inbound network density at time $t$, and 3) A new inbound tie was added within the last 6 months before time $t$.

**Controls:** 1) Trend, 2) Number of words, 3) Number of references, 4) Version age, 5) Number of prior revisions, and 6) Having an outbound network.

**Analysis:** Fixed-effects logit models

**Results**

**Alter Exposure (H1):** Supported

- Being cited by other rules intensifies rule revisions, and both sub-types of revisions.
- In contrast, the presence of an outbound network has no significant effects on either type of revisions.

**Redundant Exposure (H2):** Partially supported

- Inbound density has significant and negative effects on external revisions (but no significant effect on internal revisions).
- This means that non-redundant exposure intensifies external revisions. Inbound networks rich in structural holes facilitate the integration of new research-based knowledge into the rules.

**New Exposure (H3):** Partially supported

- Adding a new tie has positive significant effects on internal revisions, and negative significant effects on external revisions.
- During the initial time period in which a rule is exposed to a new tie, internal solutions arise sooner than external solutions, and this intensifies internal revisions and eliminates the need for external revisions, thereby impeding the integration of new research-based knowledge into the rules.

- This means that exposure to new ties intensifies exploration-type rule changes. At the same time, this can eliminate the need for exploration-type changes and thereby impede research integration.

**Conclusions and Implications**

- We connect models of organizational learning with models of networks to formulate a new model of organizational knowledge evolution.
- We conceptualize organizational knowledge as a dynamic network that evolves through node-level learning processes.
- We find that inbound networks affect the speed and direction of change of individual nodes by shaping their exposure to other nodes.

**Implications:**

1. Ties between knowledge nodes are a fundamental driver of knowledge change!
2. Knowledge change intensifies when knowledge nodes are connected to other nodes, when their ties are non-redundant, and when new ties are added to their inbound networks.
   a. Non-redundant ties intensify exploration-type changes more than exploitation-type changes.
   b. New ties intensify exploitation-type changes more than exploration-type changes.
3. Knowledge change is a structural phenomenon driven by relationships and processes located on the network level.