



Sensing – Seizing - Reconfiguring

The critical role of sensing in dynamic capabilities
and its interaction with organization structure

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CCC Faculty Day 2016
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Following Teece's (2007) Vision:

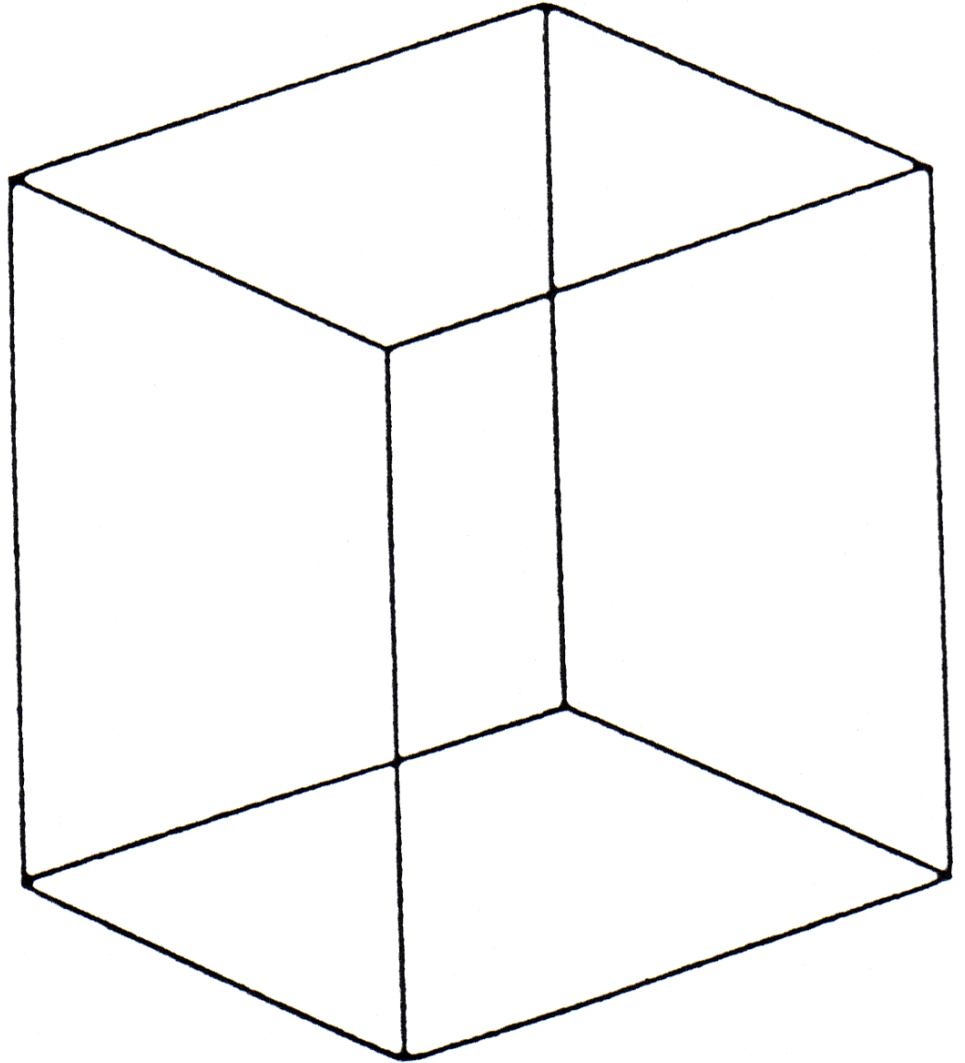
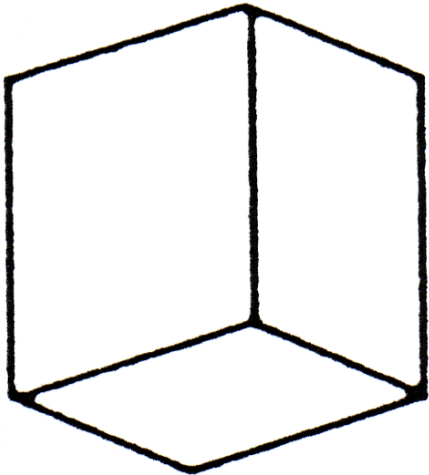
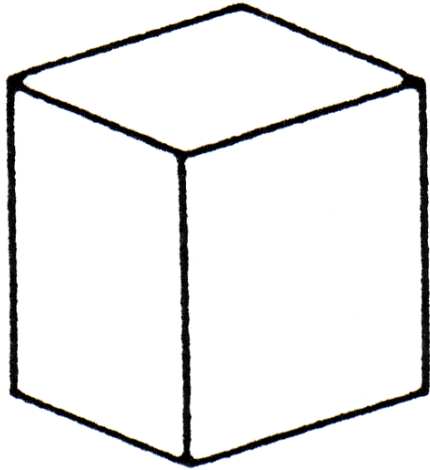


A “Biased” Snapshot of Past Research:

- Teece, Pisano & Shuen (1997).
- Eisenhardt & Martin (2000)
- Bingham, Eisenhardt & Furr (2007)
- Winter (2003).
- Teece (2007).
- Helfat & Winter (2011).
- Helfat & Peteraf (2015).

Sensing – Perceiving – Interpreting:

- Examples: Picture an old or young woman.
- Necker's Cube.
- CEO cognition and mental activities.
- Connie's writing on cognition; Kathy's writing on simple rules.
- Heuristics vs. Dual Process Theory.
- Fast Environmental Changes.
- CEOs as experts.
- Bill Simon: Buying → Selling bonds.



The paomnnehil pweor of the hmuan mnid

Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttar in what oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a total mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

Purple

Blue

Red

Red

Black

Blue

Orange

Green

Brown

Blue

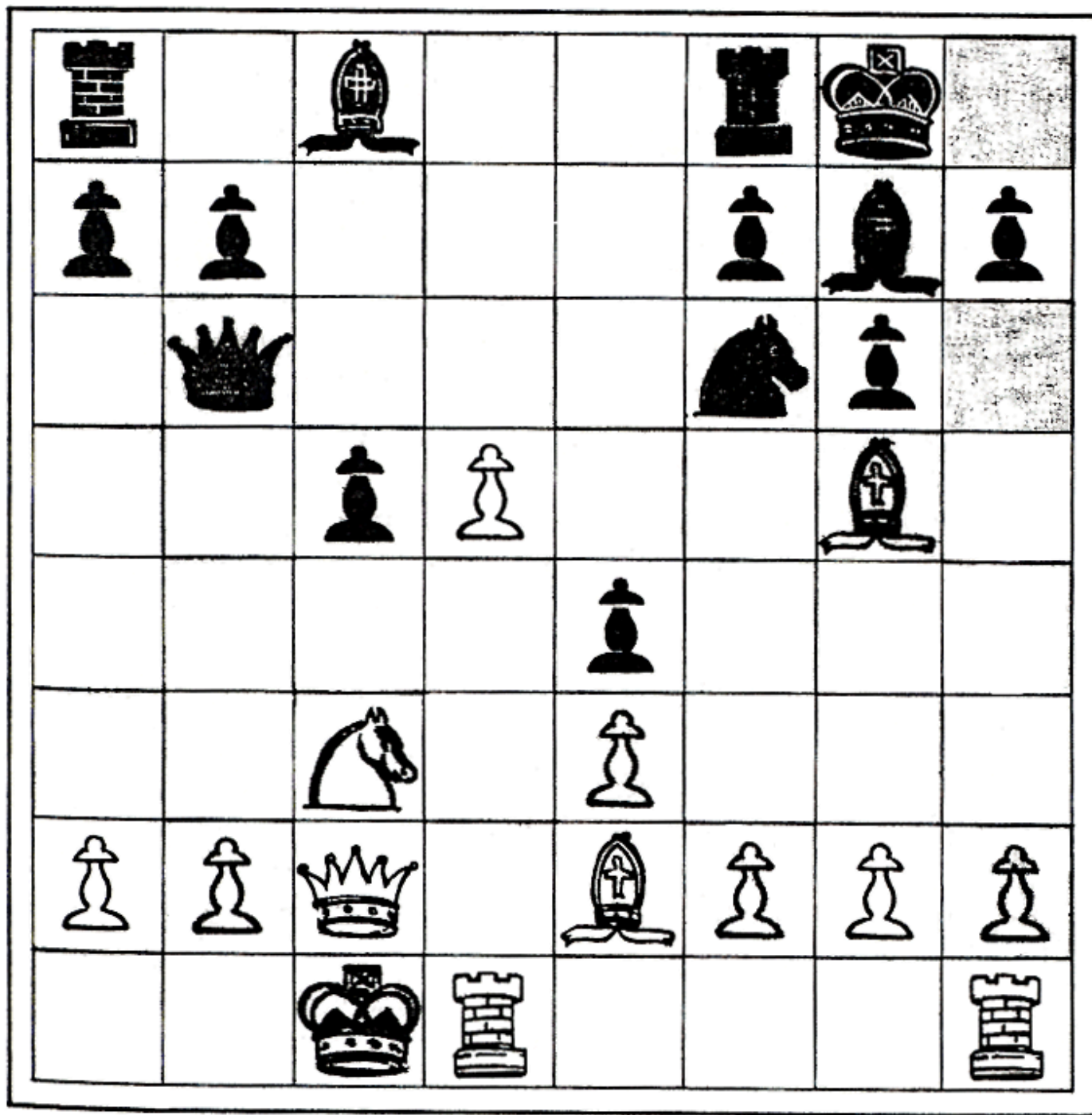
Yellow

Purple

The Style of Expertise:

- Simon's focus on Pattern Recognition
- The role of memory
- Degroot's Study of Chess
- A Qualitative Formula of Intuition
- Sensing and Organizational Structure





Expertise in Chess

Task: 25 pieces on board
Shown for 10 seconds
Experts and laypersons try to reconstruct the board

Condition 1: Pieces spread randomly on board

Finding: No difference between Novices and Grand Masters. Both reconstruct about 6 pieces correctly.

Condition 2: Pieces on the board reflect a meaningful situation.

Finding: Novices reconstruct 6 pieces,
Grand Masters 23-24 pieces.

Intuition = Intelligence + a lot of experience

Hierarchical Sensing Model

Elad Green & Zur Shapira

- Dynamic capabilities: sense->perceive->seize->configure
- How should organizations be structured for accurate and timely sensing of shifts in the environment?



- Structure is hierarchical
(no overlap in span of control)

CEO



Level 2



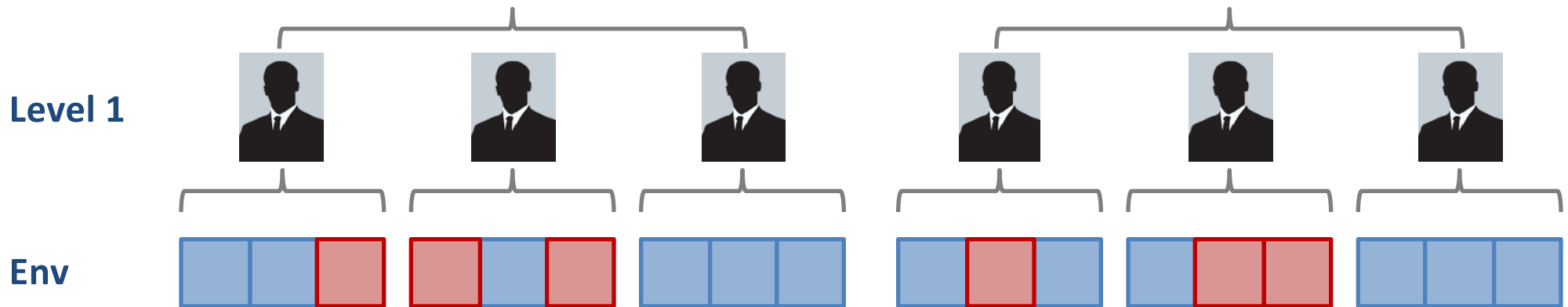
Level 1



Env



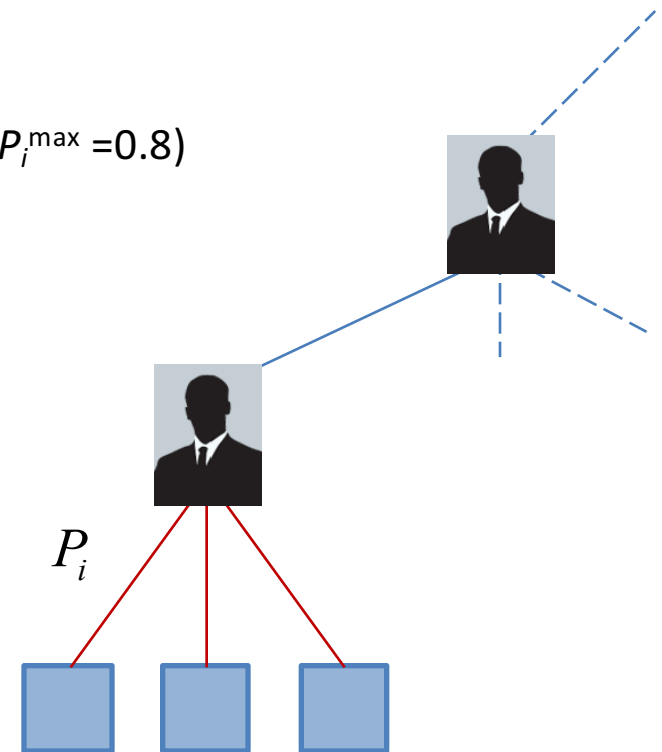
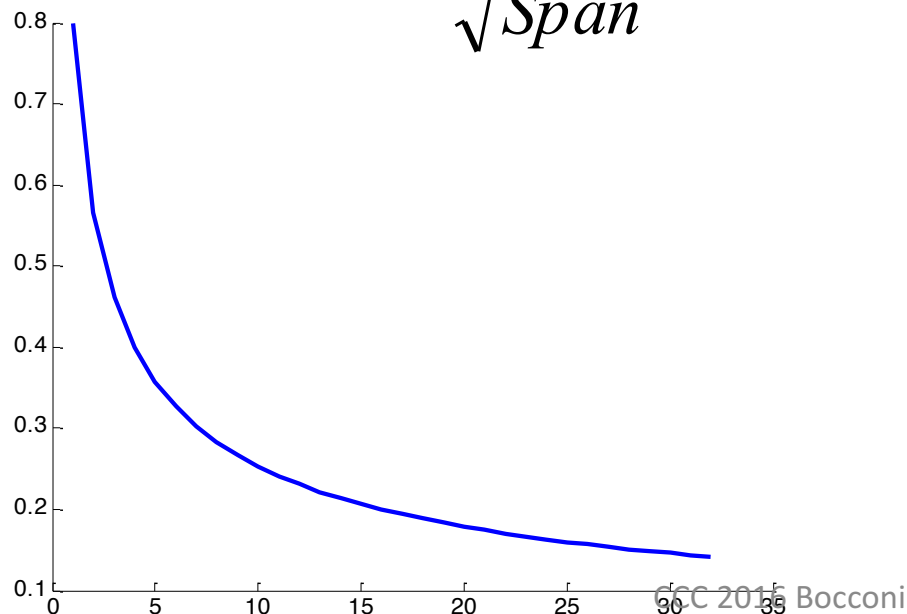
- A shift in the environment is modeled as a shock of extent **S**: **S**% of the environmental attributes change. Attributes that change are randomly selected.



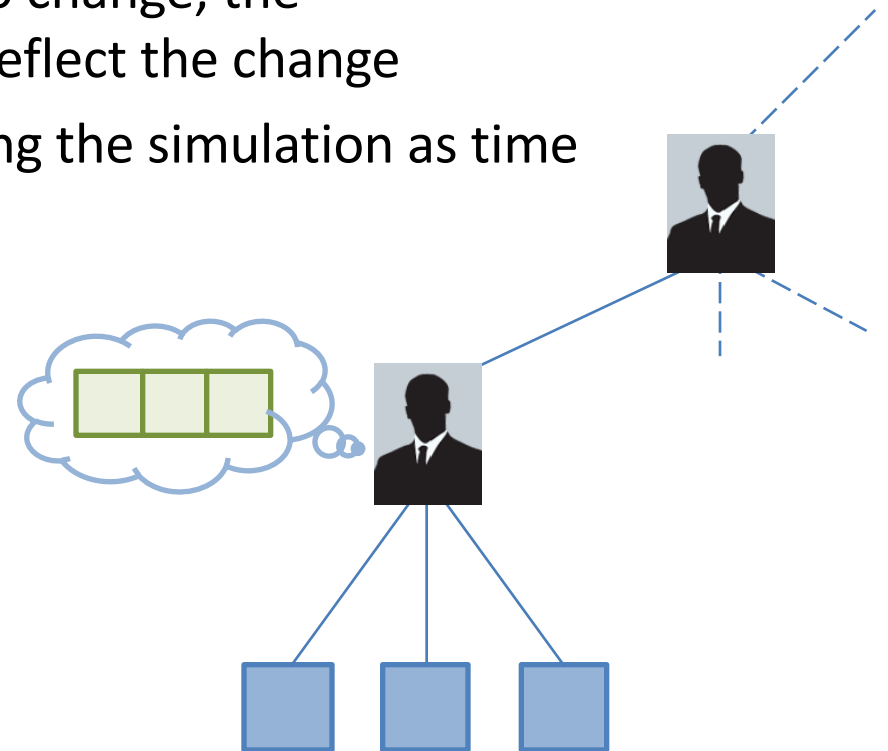
- Each DM (Decision Maker) in the organization:
 - **Perceives** correctly a change in each environmental attribute with a probability (P_i) that decreases with the no. of attributes she is responsible for (**Span**):

$$P_i = \frac{P_i^{\max}}{\sqrt{\text{Span}}}$$

(in simulations: $P_i^{\max} = 0.8$)



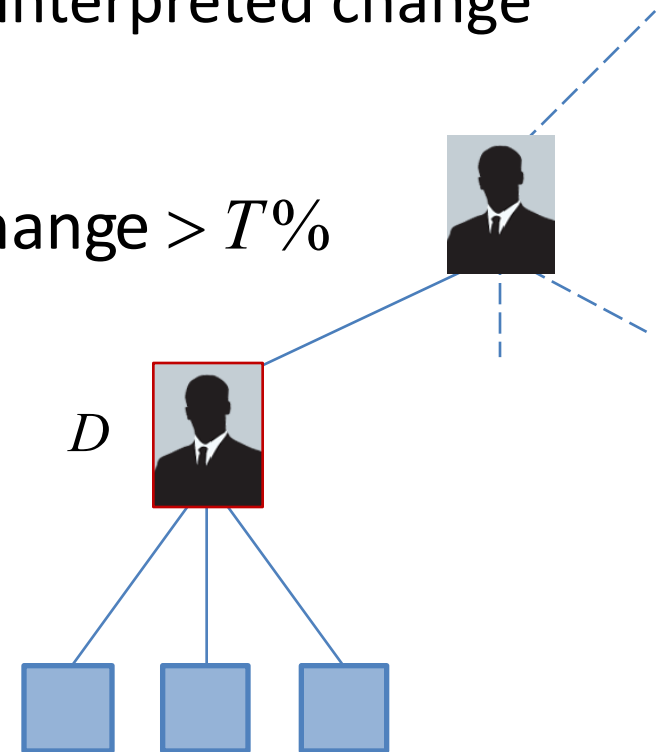
- Each DM (Decision Maker) in the organization:
 - Updates her beliefs according to her perception of the environmental attributes
 - If an attribute has been perceived to change, the corresponding belief is updated to reflect the change
 - Beliefs are repeatedly updated during the simulation as time advances



- Each DM (Decision Maker):
 - **Interprets** her updated beliefs and **decides** whether to alert her superior:

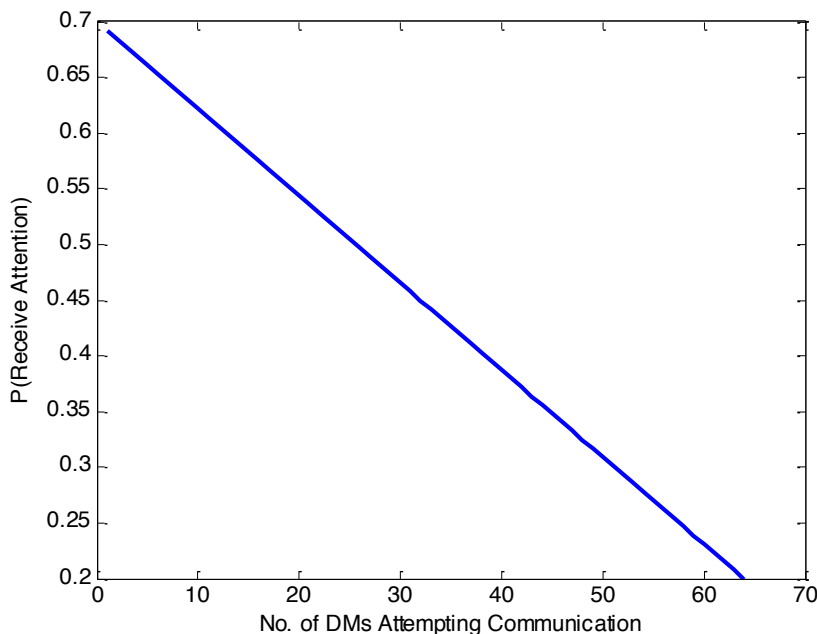
Decision D is to alert if the magnitude of interpreted change exceeds a threshold $T\%$

$D = \begin{cases} \textit{alert} & \text{if magnitude of interpreted change} > T\% \\ \textit{otherwise} & \end{cases}$



- Each DM (Decision Maker):
 - If the decision is to alert, the DM **gets the superior's attention** with a probability (Q_a) that decreases with the no. of other DMs (d) that are making concurrent attempts:

$$Q_a = Q_a^{\max} \frac{(d+1)}{k} (Q_a^{\max} - Q_a^{\min})$$

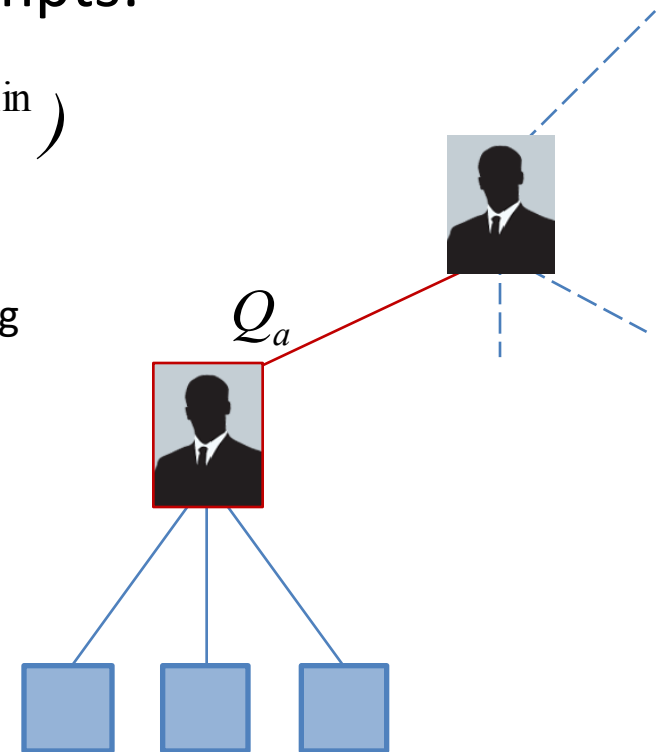


d = no. of DMs attempting to alert the superior

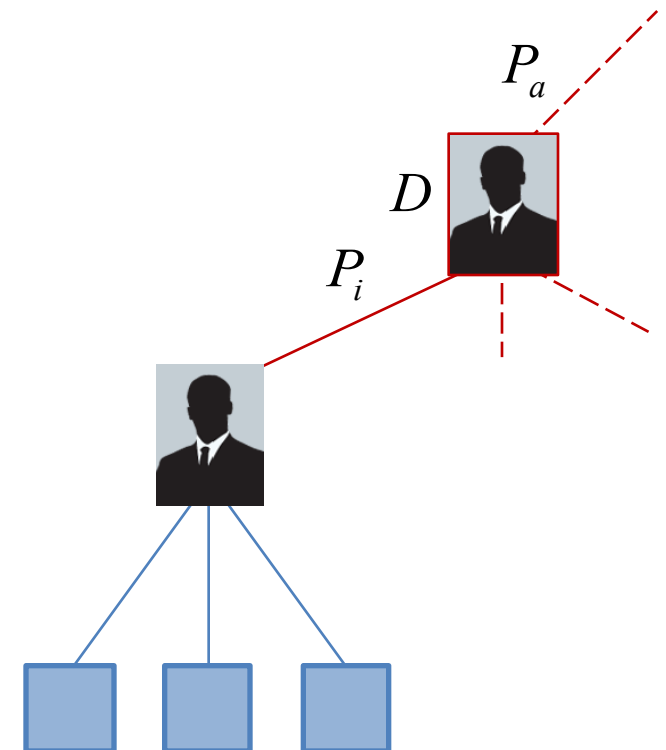
k = a constant that depends on the no. of DMs in that level ($k > d$)

(in simulations:

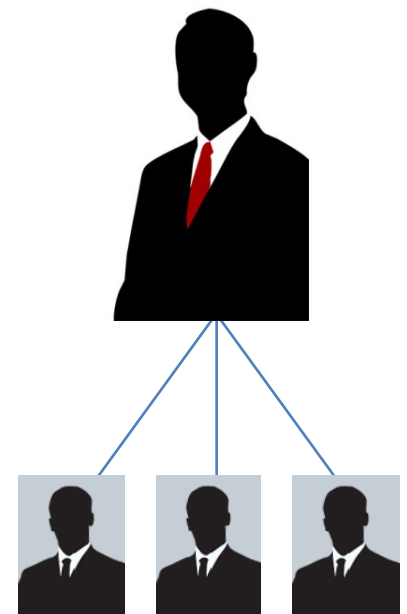
$Q_a^{\min} = 0.2, Q_a^{\max} = 0.7$)



- The process repeats for each DM in the organization, from bottom to top:
 - **Perception** of signals from subordinates and update of DMs beliefs
 - **Interpretation and decision** whether to alert the superior
 - If decision is to alert - **attempt to get superior's attention**



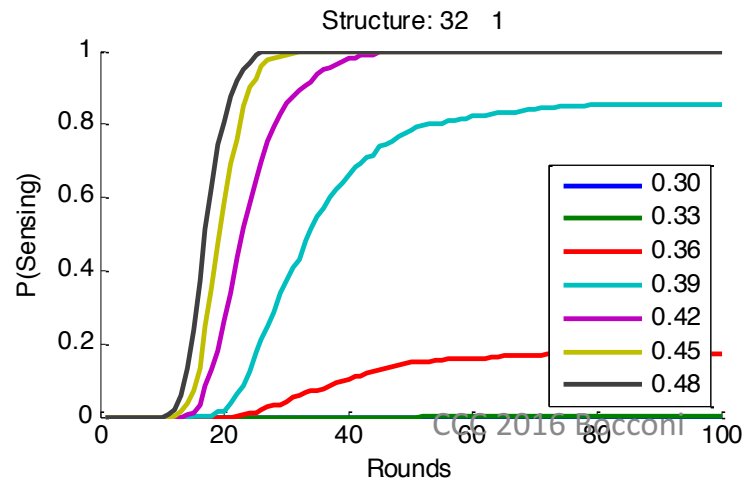
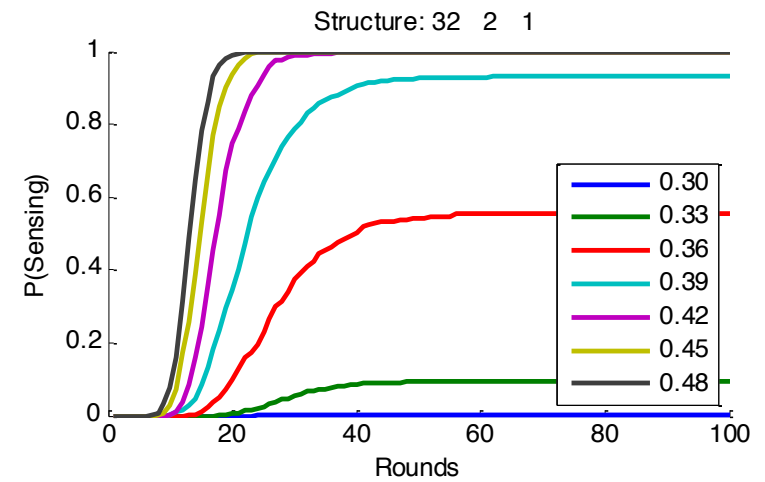
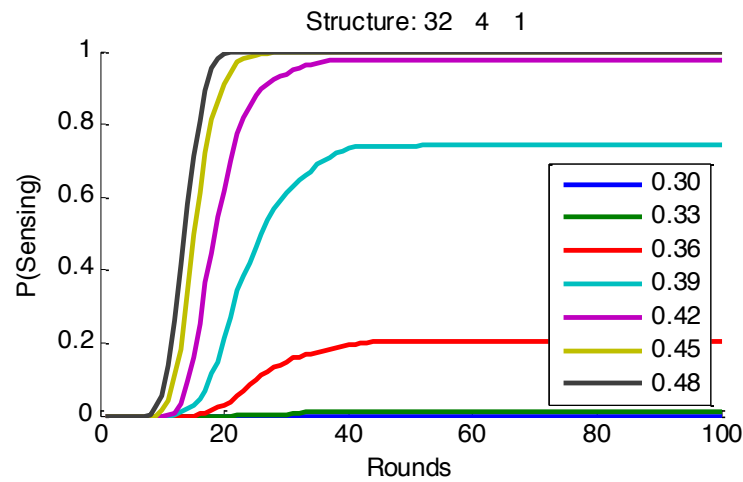
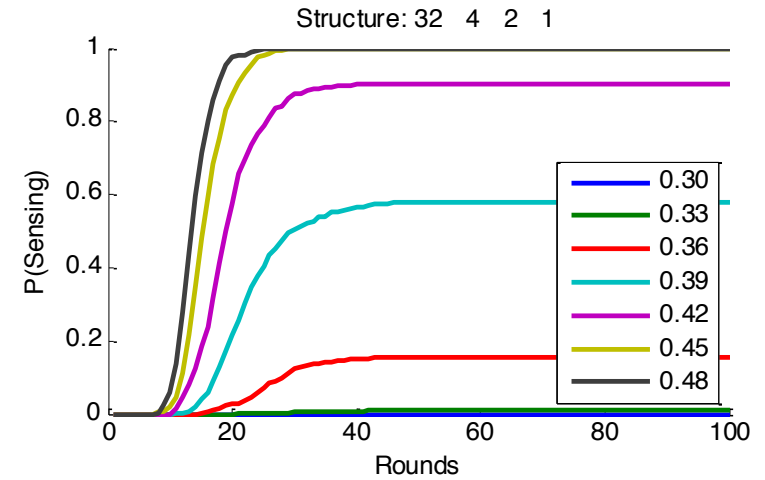
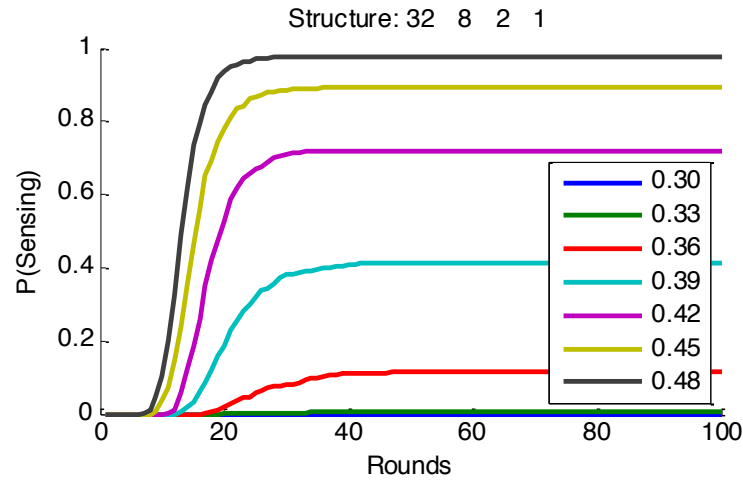
- The process repeats for each DM in the organization, from bottom to top:
 - **Perception** of signals from subordinates
 - **Decision** whether to alert the superior
 - If decision is to alert - **attempt to get superior's attention**
- The process ends with the CEO, who makes the final evaluation whether an environmental shock has occurred.



Hierarchical Sensing Model

- We induce environmental shocks in a range around the threshold **T%** that the organization is tuned to sense.
- Model parameters:
 - Various organizational designs
 - E.g.: [16 4 1] denotes an org. design of 16 DMs at level 1 (bottom level), 4 DMs at level 2, and the 1 CEO
 - For each org. design: multiple levels of env. shock around the threshold **T=40%**
 - For each env. shock: 500 simulations (results are averaged across simulations)
 - Each simulation lasts: 100 rounds (each round DMs perceive, update beliefs, interpret, and alert; rounds reflect time)
 - # env. attributes: 512
 - DMs threshold to identify env. change: 40%
 - Probability parameters: $P_i^{\max} = 0.8$
 $Q_a^{\max} = 0.7$
 $Q_a^{\min} = 0.2$

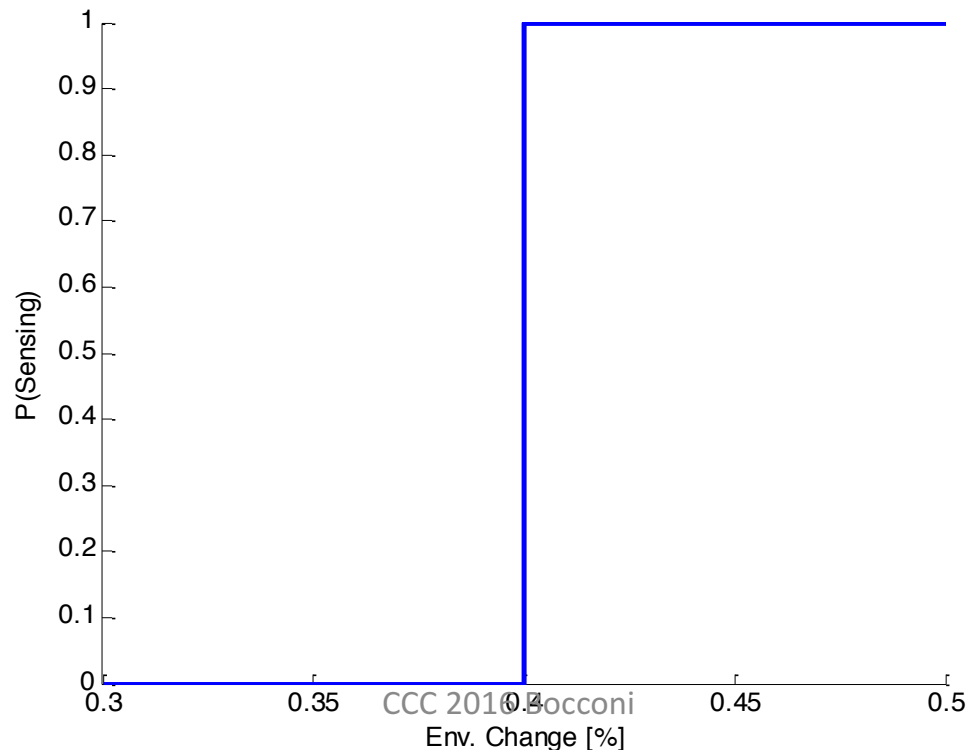
- P(sensing) over time
 - Plot per structure
 - Curve per level of env. change
-
- Probability of sensing increases with level of env. change, and sensing delay decreases



Notation:
 Structure [16 4 1]
 denotes an org. design of
 16 DMs at level 1
 (bottom level), 4 DMs at
 level 2, and the CEO

P(Sensing)

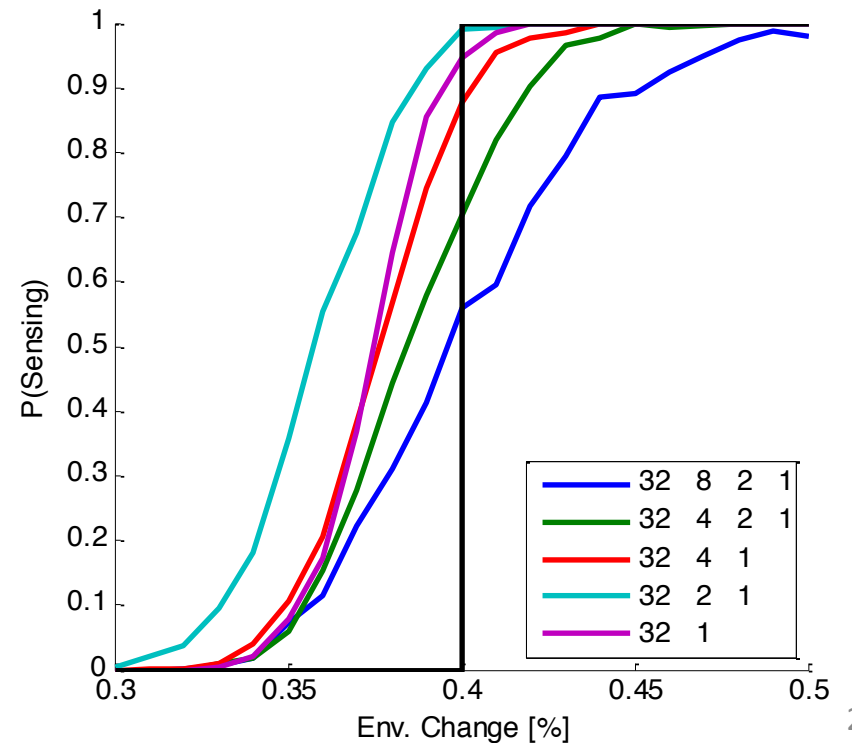
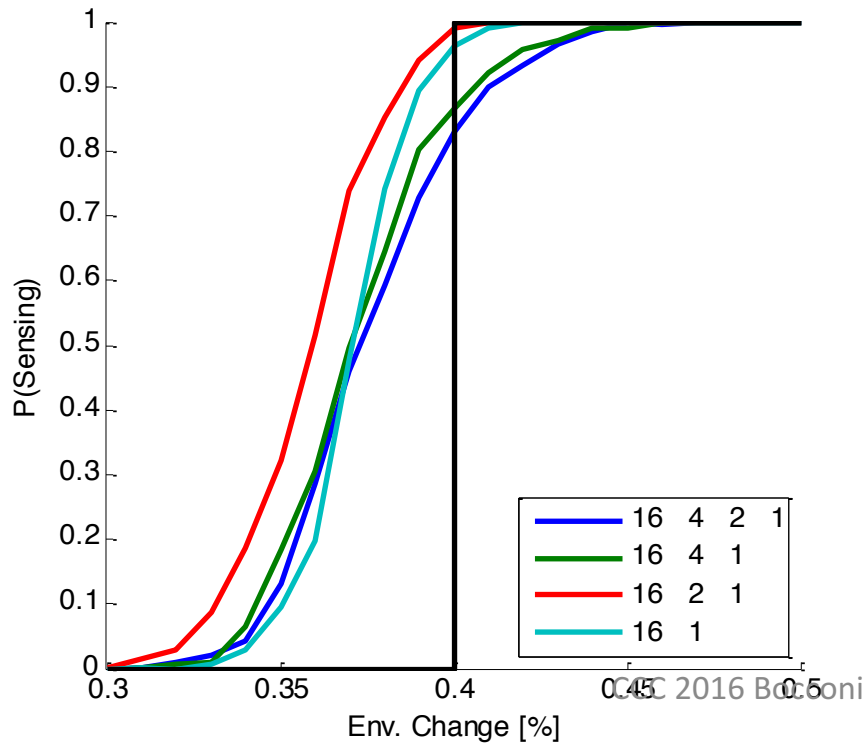
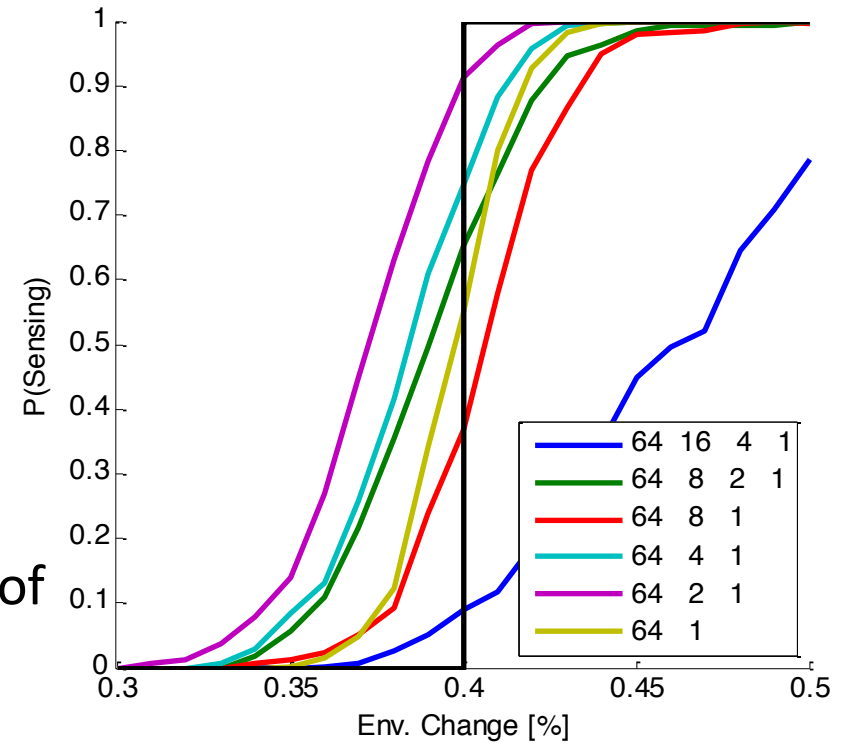
- What is the **probability** of sensing a change in the environment, for different levels of environmental shocks?
- The ideal is a **step function**: no sensing below the threshold (zero false-alarms), and perfect sensing above the threshold (100% true detections)



P(Sensing)

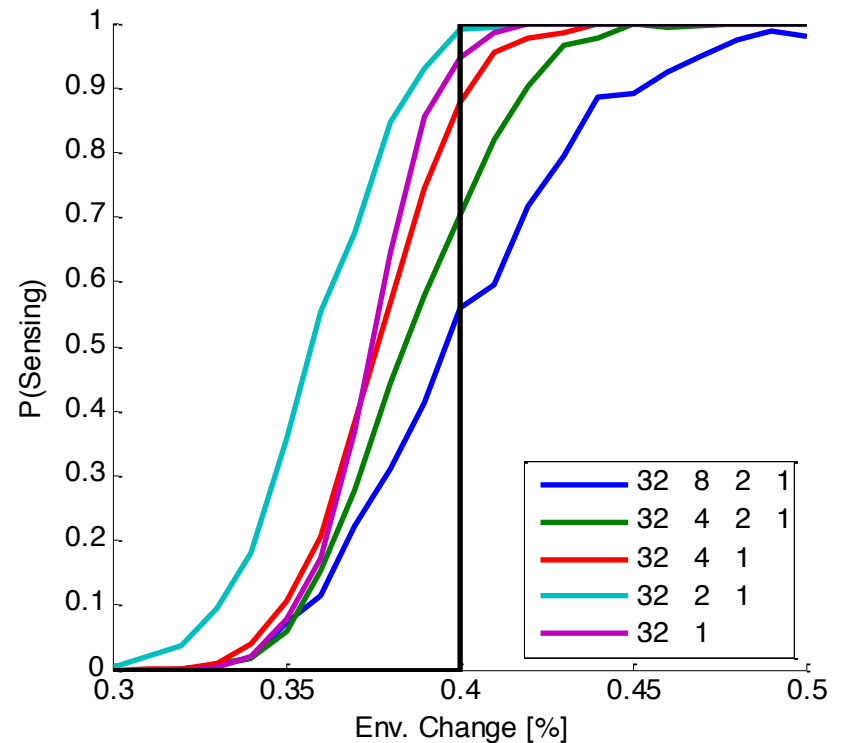
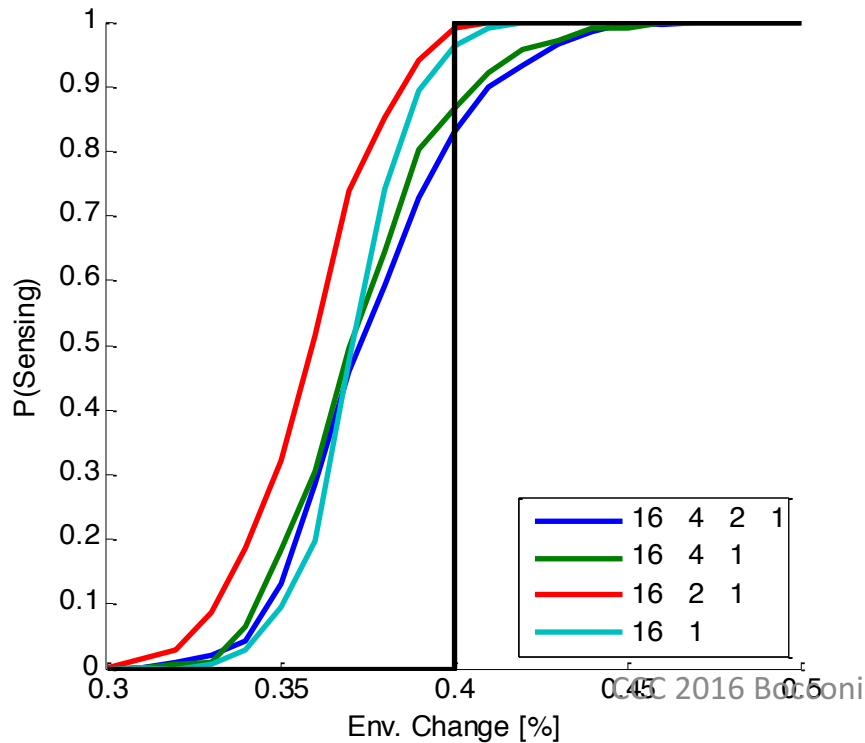
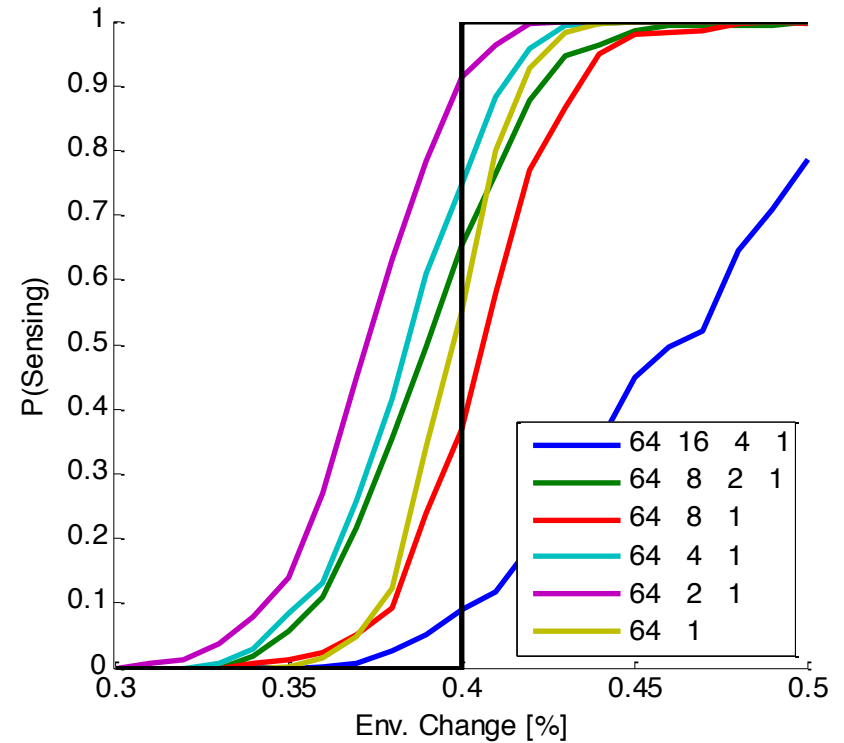
- Plots by organizational size (total no. of DMs)
- Curve per organizational structure
- P(Sensing) is computed at Round=100 and averaged across simulations

Notation: [16 4 1] denotes an org. design of 16 DMs at level 1 (bottom level), 4 DMs at level 2, and the CEO



P(Sensing)

- Plots by organizational size (total no. of DMs)
- Curve per organizational structure
- P(Sensing) is computed at Round=100 and averaged across simulations
- Wider spans of control (flatter orgs.) increase probability of sensing, but also increase false-alarms

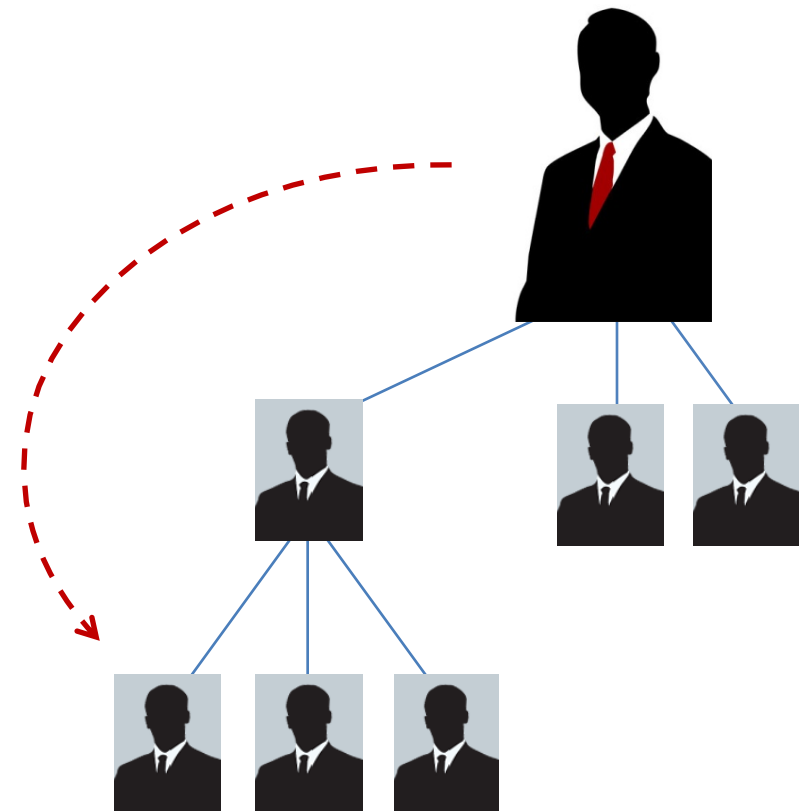


Enhancing Sensing

- The CEO may receive an indication that “something is going on”, yet evidence of an environmental shock is inconclusive.
- In this case, the CEO may bypass his immediate subordinates (Level 2 or 3), and **directly inquire with DMs at Level 1**.

- **Configuration:**

- Org. is tuned for a 40% env. change
- CEO inquires when 20% of his immediate subordinates indicate change
- CEO inquires 20% of DMs at L1 (only under VPs who did not indicate change)
- CEO’s perception of the inquired DMs’ evaluations is errorless



Summary

- Increased competition necessitates targeting top quality projects
- An important determinant of DC is early detection of opportunities and environmental changes hence the need to attract top management's attention
- CEO's SDM is an associative rather than a linear process. We need a better understanding of this process.
- Dynamic capabilities application process
Sense->Perceive->Infer->Seize->Reconfigure

A Look to the Future:

- The most important progress in (human) science over the last two decades.
- Study of the brain
- AI

Thank you David for introducing
us to dynamic capabilities.
And thanks to all of you for listening!