# Disclosure and Incentives in Teams

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# Introduction

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After production occurs, teams **communicate** their product to third-parties:

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Individual interests are aggregated into collective communication decisions via a team's organizational hierarchy and governance structure.

# Introduction

**Voice Rights:** "who can speak on behalf of an organization."

Zuckerman (2010), Freeland and Zuckerman (2018)

Allocation of Voice Rights → Individual and Collective Accountability → Productive Incentives

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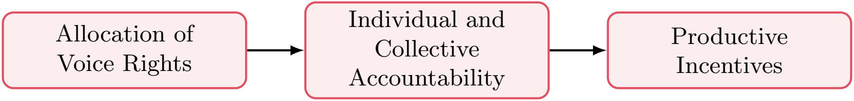

# In This Paper

This paper studies a **team production** and **team communication** environment.

We propose a new communication model — of team communication — and combine it with a simple productive environment in order to study how equilibrium communication of team outcomes affects team members' productive incentives.

# Three Contributions

1. New model of team communication.
    - Communication protocol:
      Disclosure of team's productive outcome (verifiable information).
    - Team disclosure decisions aggregate individual recommendations through some deliberation procedure, which determines individuals' voice rights.
    - We establish a relationship between voice rights and the degree to which individuals are held accountable for "team failures."

# Three Contributions

**1.** New model of team communication.

**2.** How to allocate voice rights to promote individual effort incentives?

- Low team externalities environment:
  - → Give team members unilateral rights to <u>disclose</u> team outcomes.
- High team externalities environment:
  - → Give team members unilateral rights to <u>veto disclosure</u> of team outcomes.

# Three Contributions

1. New model of team communication.

2. How to allocate individual voice rights to promote productive incentives?

3. Interpretation of communication equilibrium as corporate culture.

   - Formalize one aspect of corporate culture: individual vs. group accountability.
   - Connect our design results to recommended business practices.

# Relation to Previous Literature

**1.** Multi-sender Communication.

Milgrom and Roberts (1986), Battaglini (2002), Gentzkow and Kamenica (2016).

Networks/Hierarchies: Squintani (2020), Ambrus, Azevedo and Kamada (2013).

+ Disclosure of Verifiable Information.

Grossman (1981), Milgrom (1981), Dye (1985).

**Our paper:** model of communication by a group of senders.

**2.** Career Concerns and Moral Hazard in Teams.

Holmstrom (1982, 1999), Jeon (1996), Auriol, Friebel, and Pechlivanos (2002), Bar-Isaac (2007), Arya and Mittendorf (2011), Chaliotti (2016).

+ Reputation in Committees.

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**Our paper:** we show that voice rights can be used as an incentive tool.

**3.** Holdups and Incomplete Contracting.

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**Disclosure Environment**

Equilibrium Team Disclosure

Deliberation and Incentives

Further Results

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# Model - Disclosure in Teams

A team is made up of $n \geqslant 2$ team-members. ($N = \{1, ..., n\}$).

Team produces outcome $\omega = (\omega_1, ..., \omega_n)$, drawn from distribution $\mu$.

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**Interpretation.** Career Concerns in Teams

- $\theta$ is an observable random outcome of team production.
- $\omega_i$ is the reputational value of $\theta$ to team member $i$: $\omega_i = \mathbb{E}\left[i\text{'s type}|\theta\right]$.
- $\mu$ is the joint distribution of such values implied by team's productive process.

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**Assumptions.**

- $\omega_i \in \Omega_i$, a finite subset of $\mathbb{R}$, with $|\Omega_i| > 1$.
- $\mu$ has full support over $\Omega = \Omega_1 \times ... \times \Omega_n$.

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## Team Member's Payoffs

- If $\omega$ is disclosed, then team member $i$'s payoff is $\omega_i$.
- If $\omega$ is not disclosed, observer "sees" the absence of disclosure and infers $\omega_i$. Team member $i$'s payoff is then

$$\omega_i^{ND} = \mathbb{E}\left[\omega_i | \text{no disclosure}\right].$$

# Deliberation Procedure

Each team member sees outcome $\omega$ and makes
an individual disclosure recommendation $x_i(\omega) \in \{0, 1\}$ (or mixes).

Recommendations are summarized by $X(\omega) \subseteq N$,
the set of team members who favor disclosure of outcome $\omega$.

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$$d(\omega) = D\big(X(\omega)\big).$$

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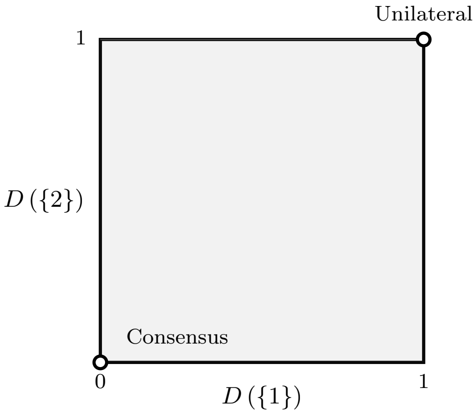
**Assumptions.** The deliberation procedure $D$

1. Respects unanimity: $D(\varnothing) = 0$ and $D(N) = 1$.
2. Is monotone: $X' \subseteq X$ implies $D(X) \geqslant D(X')$.

# Deliberation in Two-Person Team

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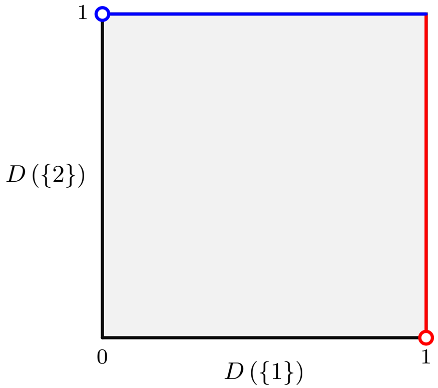


- Protocol can be fully described by $D(\{1\})$ and $D(\{2\})$, because $D(\varnothing) = 0$ and $D(\{1,2\}) = 1$.
- In **red** are protocols where team-member 1 can unilaterally choose disclosure.
- In **blue** are protocols where team-member 2 can unilaterally choose disclosure.

# Equilibrium

Given a deliberation procedure $D$, disclosure recommendations $x_i$ for $i \in N$, and no-disclosure posteriors $\omega_i^{ND}$ for $i \in N$ constitute an **equilibrium** if

1. Individual disclosure strategies are as if pivotal:

$$\omega_i > \omega_i^{ND} \Rightarrow x_i(\omega) = 1 \text{ and } \omega_i < \omega_i^{ND} \Rightarrow x_i(\omega) = 0.$$

2. Individual disclosure recommendations are determined by own outcome values:

$$\omega, \hat{\omega} \in \Omega \text{ with } \omega_i = \hat{\omega}_i \Rightarrow x_i(\omega) = x_i(\hat{\omega}).$$

3. No-disclosure posteriors are Bayes-consistent:

$$\omega_i^{ND} = \mathbb{E}\left[\omega_i | \text{no disclosure}\right].$$

Disclosure Environment

**Equilibrium Team Disclosure**

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# Equilibrium Team Disclosure

**Theorem 1.**

1. A full-disclosure equilibrium exists, with

$$\omega_i^{ND} = \min(\Omega_i) \text{ for every } i \in N.$$

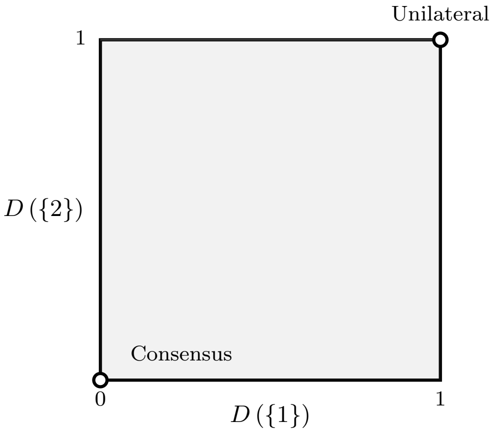
2. If $i$ is a team-member who can unilaterally choose disclosure, then

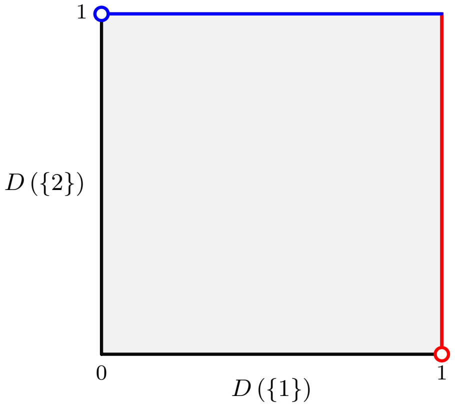
$$\omega_i^{ND} = \min(\Omega_i) \text{ in every equilibrium } \underline{\text{without full disclosure}}.$$

3. Conversely, if $I \subseteq N$ is the set of team-members who cannot unilaterally choose disclosure, there exists an equilibrium <u>without full disclosure</u> where

$$\omega_i^{ND} > \min(\Omega_i) \text{ for every } i \in I.$$

# Equilibrium Team Disclosure



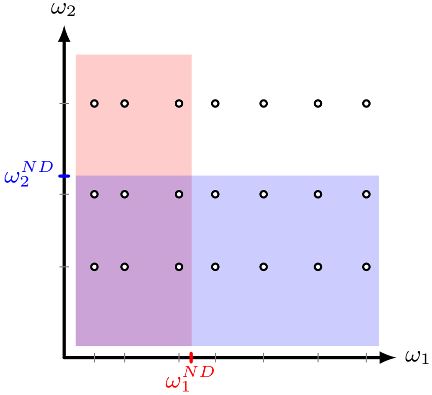


1
$D(\{2\})$
0
1
$D(\{1\})$

# Proof Intuition with $n = 2$

Suppose there are two team-members, $n = 2$.

Conjecture an equilibrium with $\omega_1^{ND} > \min(\Omega_1)$ and $\omega_2^{ND} > \min(\Omega_2)$.

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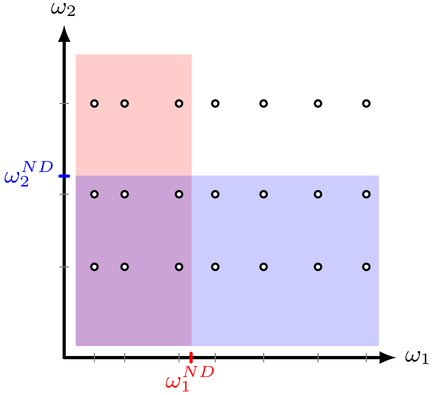


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Suppose both individuals can unilaterally disclose, so that $D(\{1\}) = D(\{2\}) = 1$.

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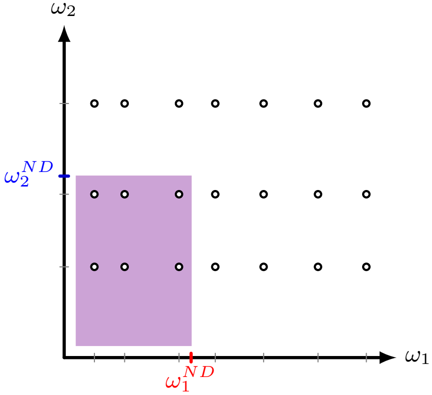


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The conjectured equilibrium unravels.

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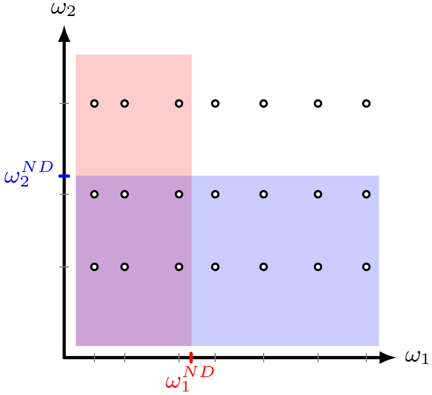


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If instead neither team-member can unilaterally disclose, so that $D(\{1\}) = D(\{2\}) = 0$.

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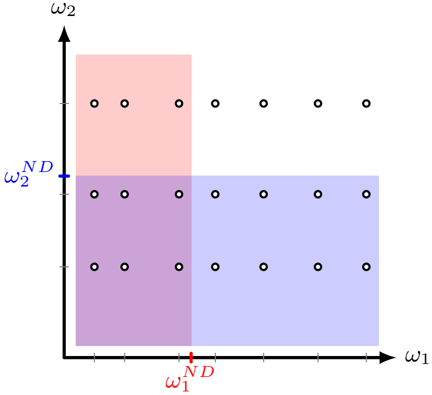


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Unraveling logic breaks, and one such equilibrium exists.

# Skepticism in Team Disclosure

**Two Lessons from Theorem 1**

**1.** The existence of disclosure equilibria in which "team failures" are concealed.

(In contrast with result in a parallel model of individual disclosure.)

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**2.** A relationship b/w an individual's <u>power</u> to disclose the team outcome and the observer's <u>skepticism</u> about that individual's value upon seeing no-disclosure.

(New mechanism introduced in a model of team disclosure.)

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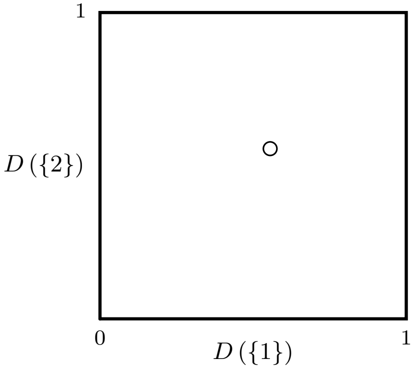
**Next Result** establishes a more refined relation between

- An individual's power to disclose team's outcome (determined by $D$).
- No-disclosure skepticism targeted at that individual (measured by $\omega_i^{ND}$).

# Voice Rights and Targeted Skepticism

Fix an initial protocol $D$ and an initial strict equilibrium.

We can determine how marginal changes to the protocol $D$ affect $\omega^{ND}$.



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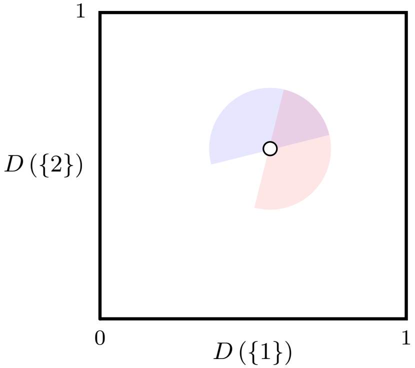
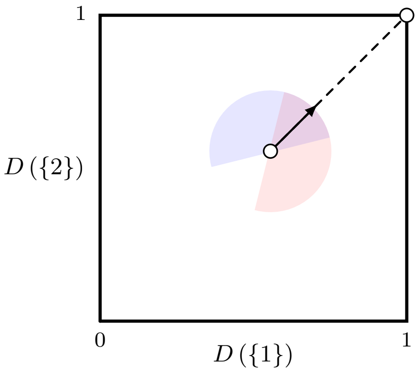



**red** area represents directions of change to deliberation procedure that increase skepticism about team member 1.

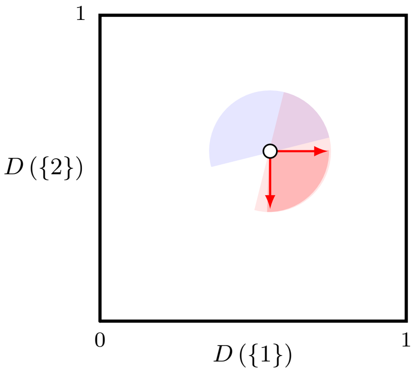
**blue** area represents directions of change to deliberation procedure that increase skepticism about team member 2.




**Proposition 1.** If the deliberation protocol becomes more unilateral, then

$$\omega_i^{ND} \text{ decreases for every } i \in N,$$

or equivalently, observer's skepticism about each team member increases.

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**Proposition 2.** If team member $i$ becomes more pivotal, so that for every $I \subseteq N$

$$i \in I \Rightarrow dD(I) \geqslant 0,$$

$$\text{and } i \notin J \Rightarrow dD(J) \leqslant 0,$$

then $\omega_i^{ND}$ decreases, meaning that the observer's skepticism about $i$ increases.

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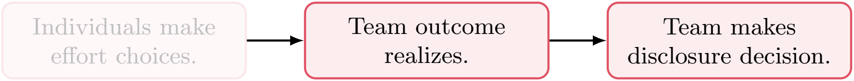


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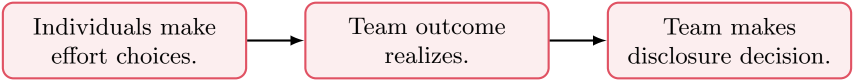


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We now study the complete environment of team **production** + team **disclosure**.

# Disclosure and Incentives

Individuals make effort choices. $\rightarrow$ Team outcome realizes. $\rightarrow$ Team makes disclosure decision.

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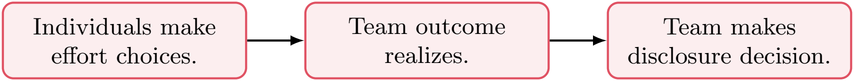
**Question.** How can the team design the procedure used to make communication decisions — voice rights — so as to incentivize individual effort provision?

# Disclosure and Incentives




**Productive Environment:**

- Each $i \in N$ <u>covertly</u> chooses effort $e_i \in \{0, 1\}$, incurring in cost $c_i > 0$ if $e_i = 1$.
- Given an effort vector $e$, the outcome distribution is $\mu(\cdot; e)$.
- Once outcome $\omega$ realizes, team chooses to disclose/not disclose it, as before.

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**Assumption.** Effort is productive: $e \geqslant e' \Rightarrow \mu(\cdot; e) \succsim_{FOS} \mu(\cdot; e')$.

**Notation.** $e_I$ indicates $e_i = 1$ if and only if $i \in I$.

# Full Effort Implementation

We want to compare deliberation procedures in terms of effort-incentive provision.

**Definition.** Deliberation procedure $D$ dominates procedure $D'$ if for every cost vector $c \in \mathbb{R}^n_{++}$ such that full effort is implementable in equilibrium under $D'$, full effort is also implementable in equilibrium under $D$.

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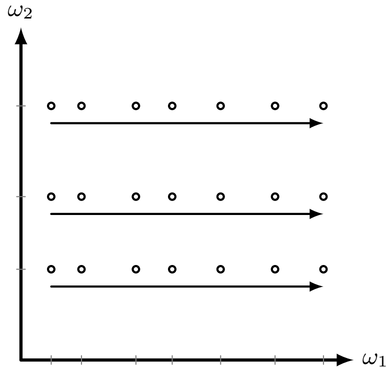
$$\underbrace{\mathbb{E}\left[\omega_i | e_N\right] - \mathbb{E}\left[\omega_i | e_{N\setminus i}\right]}_{\text{Individual Effort Benefits}} + \mathbb{P}\left[ND | e_{N\setminus i}\right] \underbrace{\left[\omega_i^{ND}(e_{N\setminus i}) - \omega_i^{ND}(e_N)\right]}_{\text{Misattributed Skepticism}} \geqslant c_i.$$




**Def.** Effort is purely self-improving if, for every $i \in N$ and every $I \subset N$,

$$\mu_{N\setminus i}(\cdot; e_I) = \mu_{N\setminus i}(\cdot; e_{I\setminus i})$$

and $\mu_i(\cdot|\omega_{N\setminus i}; e_I) \succ_{FOS} \mu_i(\cdot|\omega_{N\setminus i}; e_{I\setminus i})$.

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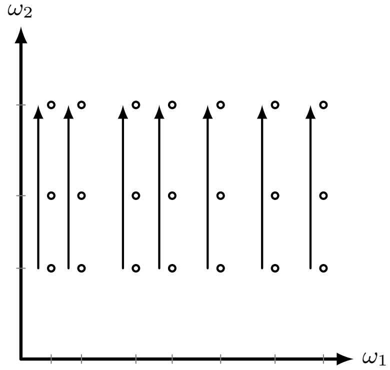
# Externalities in Productive Environment

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# Disclosure and Incentives

**Theorem 2.**

- If effort is purely self-improving, then unilateral deliberation dominates any other deliberation procedure.
- If effort is purely team-improving, then the consensus deliberation procedure strictly dominates any procedure in which some team member can unilaterally choose disclosure.

# Disclosure and Incentives

**Theorem 2.**

- If effort is <u>purely self-improving</u>, then unilateral deliberation dominates any other deliberation procedure.
- If effort is <u>purely team-improving</u>, then the consensus deliberation procedure strictly dominates any procedure in which some team member can unilaterally choose disclosure.

**Additional Result.** Monotonicity with respect to “more self-improving” and “more team-improving” changes to the productive environment.

# Proof Sketch

$$\underbrace{\mathbb{E}\left[\omega_i|e_N\right]-\mathbb{E}\left[\omega_i|e_{N\setminus i}\right]}_{\text{Individual Effort Benefits}}+\mathbb{P}\left[ND|e_{N\setminus i}\right]\underbrace{\left[\omega_i^{ND}(e_{N\setminus i})-\omega_i^{ND}(e_N)\right]}_{\text{Misattributed Skepticism}}\geqslant c_i.$$

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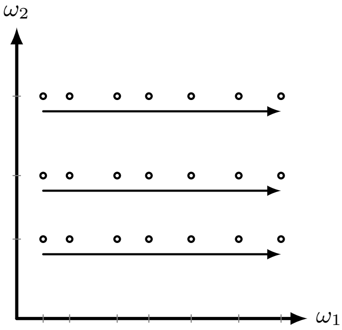


**Purely Self-Improving**

# Proof Sketch

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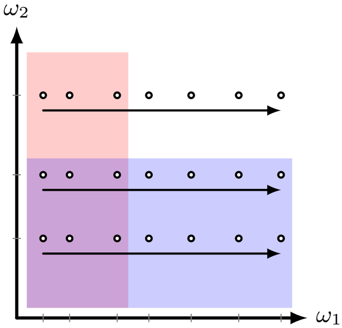


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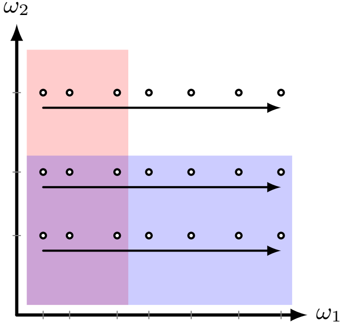


**Purely Self-Improving**

Given the eq. region of no disclosure,

$$\omega_1^{ND}(e_N) > \omega_1^{ND}(e_{N\setminus 1}).$$

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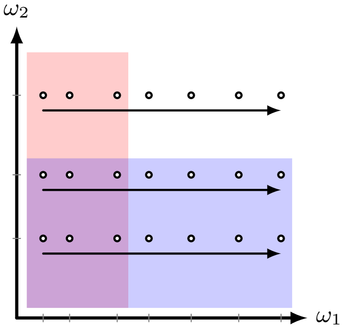


**Purely Self-Improving**

Given the eq. region of no disclosure,

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$\Rightarrow$ Misattributed skepticism reduces effort incentives.

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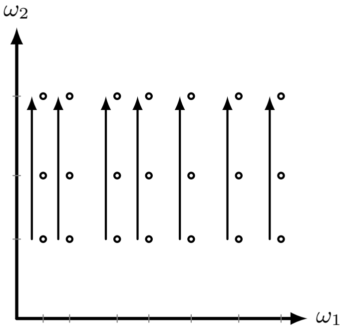


**Purely Team-Improving**

# Proof Sketch

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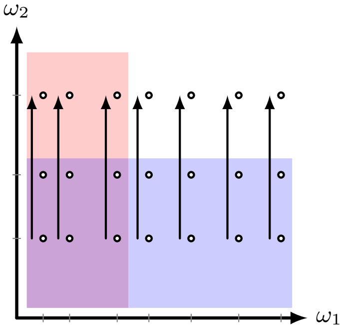


**Purely Team-Improving**

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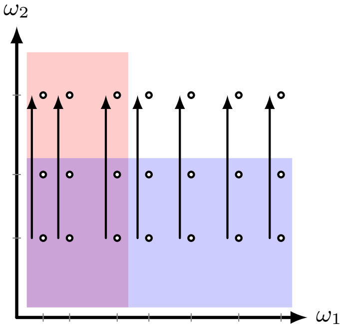


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Given the eq. region of no disclosure,

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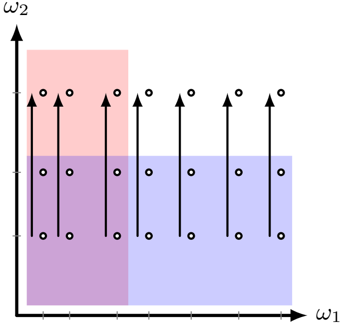


**Purely Team-Improving**

Given the eq. region of no disclosure,

$$\omega_1^{ND}(e_N) < \omega_1^{ND}(e_{N\setminus 1}).$$

$\Rightarrow$ Misattributed skepticism improves effort incentives.

# Lessons and Interpretation

**Two Lessons from Theorem 2**

1. Full disclosure implied by unilateral procedure
   $\rightarrow$ individual fully benefits from effect of effort on their own value.
2. Strategic non-disclosure implied by consensus procedure
   $\rightarrow$ individual internalizes effect of effort on fellow team members' values.

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**Interpretation:** Deliberation as Corporate Culture

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**Interpretation:** Deliberation as Corporate Culture

1. Radically transparent corporate culture $\leftrightarrow$ Unilateral disclosure procedure
   $\rightarrow$ Individual accountability for contributions to teams' successes/failures.
2. No blame game corporate culture $\leftrightarrow$ Consensus disclosure procedure
   $\rightarrow$ Team collectively suffers the burden of bad team outcomes.

# Lessons and Interpretation

**Advocacy for radically transparent culture:**

*"when used judiciously (...) blame can prod people to put forth their best efforts"*

From: "How to Win the Blame Game," Harvard Business Review.

**Advocacy for "no blame game" culture:**

*"too much transparency can create a blaming culture that may actually decrease constructive, reciprocal behavior between employees."*

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**Our contribution:**

Degree of externalities determines the fitness of culture to productive environment.

Disclosure Environment

Equilibrium Team Disclosure

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**Further Results**

Conclusion

# Further Results

**1.** Effort towards a highly-correlated outcome.

**2.** Effort-maximizing deliberation in a symmetric, binary-outcome, environment.

- In a simplified environment, we show that effort-maximizing deliberation

  **a.** Requires less consensus (more consensus) for disclosure when effort is "more self-improving" ("more team-improving").

  **b.** Requires more consensus (less consensus) for disclosure when effort is "more correlating" ("less correlating").

---

**3.** Refining the set of team-disclosure equilibria:

When is the full disclosure equilibrium "consistent with deliberation"?

Skip to Conclusion

# Effort Towards Common Outcome

**Proposition 5.** For some $\epsilon \in (0,1)$, let

$$\mu_\epsilon(\cdot; e_N) = (1-\epsilon)\mu + \epsilon\nu,$$

where $\mu$ is a full-support distribution and $\nu$ has perfect correlation across team-members' outcomes. Further, suppose $\nu \succsim_{FOS} \mu \succsim \mu(\cdot; e_{N\setminus i})$ for every $i \in N$.

Let $D$ be the unilateral protocol and $D'$ be a deliberation procedure in which no team-member can unilaterally choose disclosure. There exists $\bar{\epsilon} \in (0,1)$ such that if $\epsilon > \bar{\epsilon}$, $D'$ strictly dominates $D$.

Back

# Symmetric + Binary-Outcome Environment

Consider the following environment:

- The team has 2 team-members.
- For each team-member $i$, outcomes are binary: $\omega_i \in \{\omega_\ell, \omega_h\}$.
- Deliberation is symmetric: $D(\{1\}) = D(\{2\})$.
- The distribution of outcomes induced under full effort, $\mu(\cdot; e_N)$, is symmetric.

What is the level $D^*$ of $D(\{1\}) = D(\{2\})$ that maximizes effort-incentives?

Back

# Symmetric + Binary-Outcome Environment

Effort environment is described by two measures:

**1.** $\Delta_\rho = \bar{\rho} - \rho$ measures the degree to which effort improves outcome correlation.

$$\bar{\rho} = \frac{\mu\left[(\omega_\ell, \omega_\ell); e_N\right]}{\mu\left[(\omega_h, \omega_\ell); e_N\right] + \mu\left[(\omega_\ell, \omega_h); e_N\right]} \text{ and } \rho = \frac{\mu\left[(\omega_\ell, \omega_\ell); e_{N\setminus i}\right]}{\mu\left[(\omega_h, \omega_\ell); e_{N\setminus i}\right] + \mu\left[(\omega_\ell, \omega_h); e_{N\setminus i}\right]}$$

indicate the correlation between team-members' low outcomes.

**2.** $\Delta_\sigma = \bar{\sigma} - \sigma$ measures the degree to which effort is self-improving.

$$\bar{\sigma} = \frac{\mu\left[(\omega_i = \omega_h, \omega_{-i} = \omega_\ell); e_N\right]}{\mu\left[(\omega_h, \omega_\ell); e_N\right] + \mu\left[(\omega_\ell, \omega_h); e_N\right]} \text{ and } \sigma = \frac{\mu\left[(\omega_i = \omega_h, \omega_{-i} = \omega_\ell); e_{N\setminus i}\right]}{\mu\left[(\omega_h, \omega_\ell); e_{N\setminus i}\right] + \mu\left[(\omega_\ell, \omega_h); e_{N\setminus i}\right]}$$

indicate the degree to which the distribution is skewed towards team-member $i$.

# Symmetric + Binary-Outcome Environment

**Proposition.**

The effort-maximizing level of $D(\{1\}) = D(\{2\})$ is fully determined by $(\rho, \bar{\rho}, \sigma, \bar{\sigma})$.

Moreover, keeping $\bar{\rho}$ and $\bar{\sigma}$ fixed,

- $D^*$ is decreasing in $\Delta_\rho$, that is, effort-maximizing deliberation requires more (less) consensus when effort is more (less) correlating.
- $D^*$ is increasing in $\Delta_\sigma$, that is, effort-maximizing deliberation requires more (less) consensus when effort is more self-improving (more team-improving).

Back

# Refining the Team-Disclosure Equilibrium Set

Remember that full-disclosure equilibria always exist.

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Remember that full-disclosure equilibria always exist.

They must be supported by (potentially off-path) observer beliefs that are maximally skeptical about a set $I \subseteq N$ of team-members such that $D(I) = 1$. That is,

$$\omega_i^{ND} = \min(\Omega_i)$$

for every team-member $i$ belonging to one such set $I$.

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for every team-member $i$ belonging to one such set $I$.

Are such (off-path) beliefs plausible given the team's deliberation procedure?

# Refining the Team-Disclosure Equilibrium Set

**Definition.**

No-disclosure beliefs $\omega^{ND}$ are consistent with deliberation for protocol $D$ if there exists some team disclosure decision $d$ with $d(\omega) < 1$ for some $\omega \in \Omega$, and a vector of individual disclosure recommendations $x$ such that

**1.** For each $i, j \in N$ with $j \neq i$, $x_i(\omega)$ is constant with respect to $\omega_j$.

**2.** The team's disclosure decision aggregates the individual disclosure strategies $x$:

$$d(\omega) = \sum_{X \subseteq N} \Pi_X(\omega) D(X) \text{ for every } \omega \in \Omega.$$

**3.** No-disclosure posteriors are Bayes-consistent.

Back

**Definition.**

A deliberation procedure $D$ is such that disclosing requires more consensus than concealing if for every subgroup $I \subseteq N$, such that $D(I) = 1$ and $D(N \setminus I) < 1$, there exists a smaller subgroup $J \subset I$ such that $D(N \setminus J) < 1$ but $D(J) \neq 1$.

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**Theorem 3.**

A full-disclosure equilibrium that is consistent with deliberation procedure $D$ exists if and only if disclosure does not require more consensus than concealing.

Back

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# Conclusion

We studied a model of **team production** + **team disclosure**.

Theoretical Perspective:

**1.** We introduced and analyzed an evidence disclosure model, where a team makes disclosure decisions through a deliberation procedure.

**2.** We proposed a new problem of designing how a team makes communication decisions with the goal of providing effort incentives.

Applied Perspective:

**1.** We established a relationship between "voice rights" in an organization and individual/collective accountability.

**2.** We interpreted our design problem as one of "designing corporate culture" and connected our results to existing business practices.