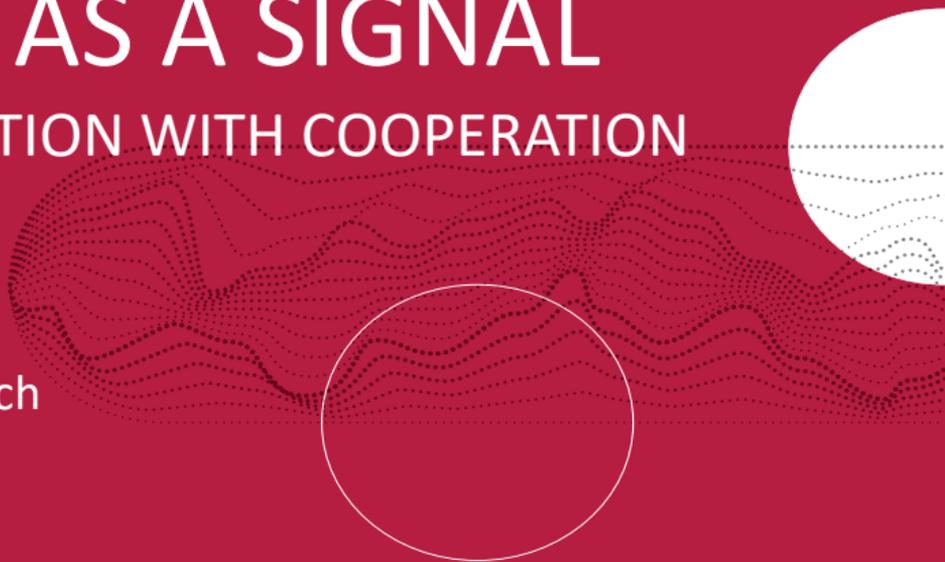


DELEGATION AS A SIGNAL

IMPLICIT COMMUNICATION WITH COOPERATION

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Communication, common as it is, is **imperfect**, both due to strategic incentives and language constraints.

- strategic frictions: lying, babbling, hiding information etc.
- language frictions: (lack of) common language, vague vocabulary, language complexity, limited attention, tacit knowledge etc.

Question

How do language frictions influence strategic behavior?

“Indecisiveness”

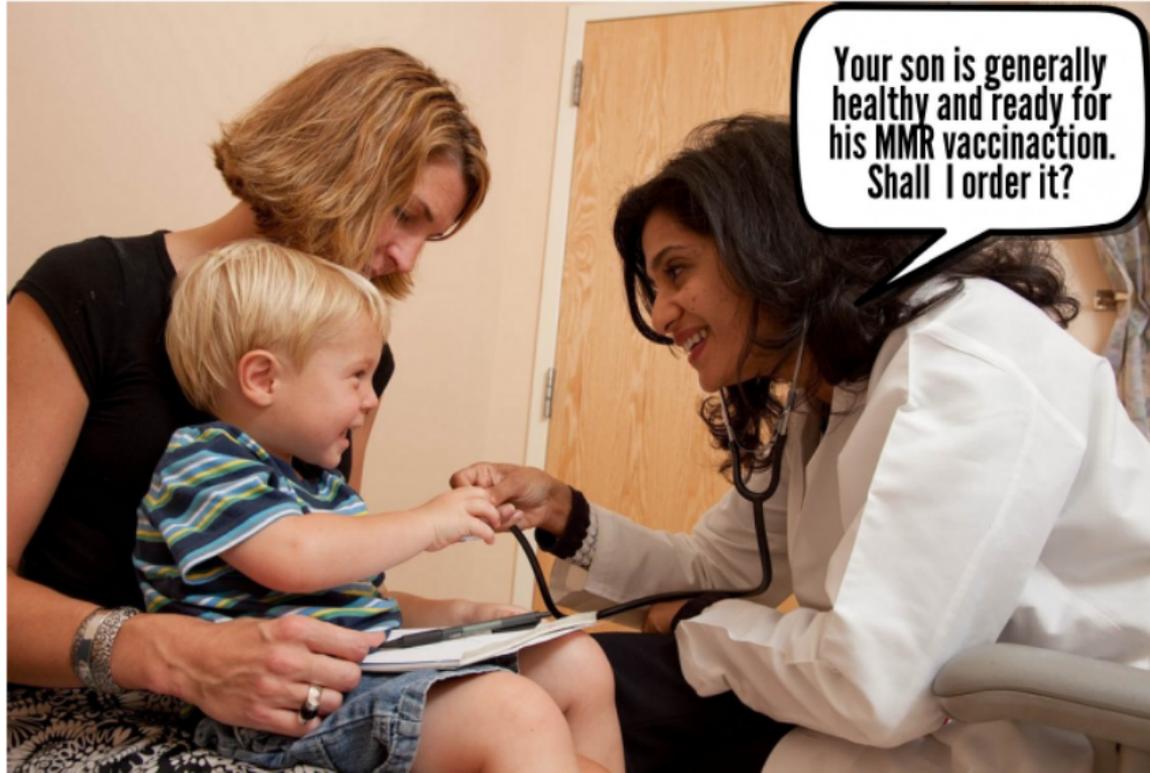


Photo by UW Health @Flickr, speech bubbles added with phrase.it

“Indecisiveness”



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“Indecisiveness”



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Non-technical summary



Doctor and patient communicate to reach a decision:

- no divergence of preferences
- two-sided private information
 - doctor observes health
 - patient observes his type (=preference parameter)
- binary action space (=two treatment options)
- patient may get some info about health (at a small cost)
 - signal is binary
 - neither the decision nor the signal are observable by the doctor
 - *possibly*: doctor's explains the state, patient takes (mental) effort in understanding it
- patient **chooses treatment himself** or **delegates to doctor**

Main result

Doctor (upon delegation) correctly recovers the patient's type and adjusts the treatment to the patient's needs.

Principal (patient)–agent (doctor) model with communication:

- utility is $u(t, x, a) = a(x - t)$ where x is health, $a \in \{0, 1\}$ is action, $t \in [0, 1]$ is patient's type;
 - $x \sim U[0, 1]$ is observed by the doctor
 - $t \sim g(t)$ is observed by the patient (g symmetric and full support)
 - both x and t *hard to communicate!*
- patient may acquire private costly signal about x
 - signal is binary, with $P(s = 1|x)$ being S-shaped
 - cost of signal is c with $c \in (0, \phi)$
- patient either **chooses treatment** or **delegates to doctor**

Main result

Signaling through delegation

Doctor's action choice is **non-monotone in health**

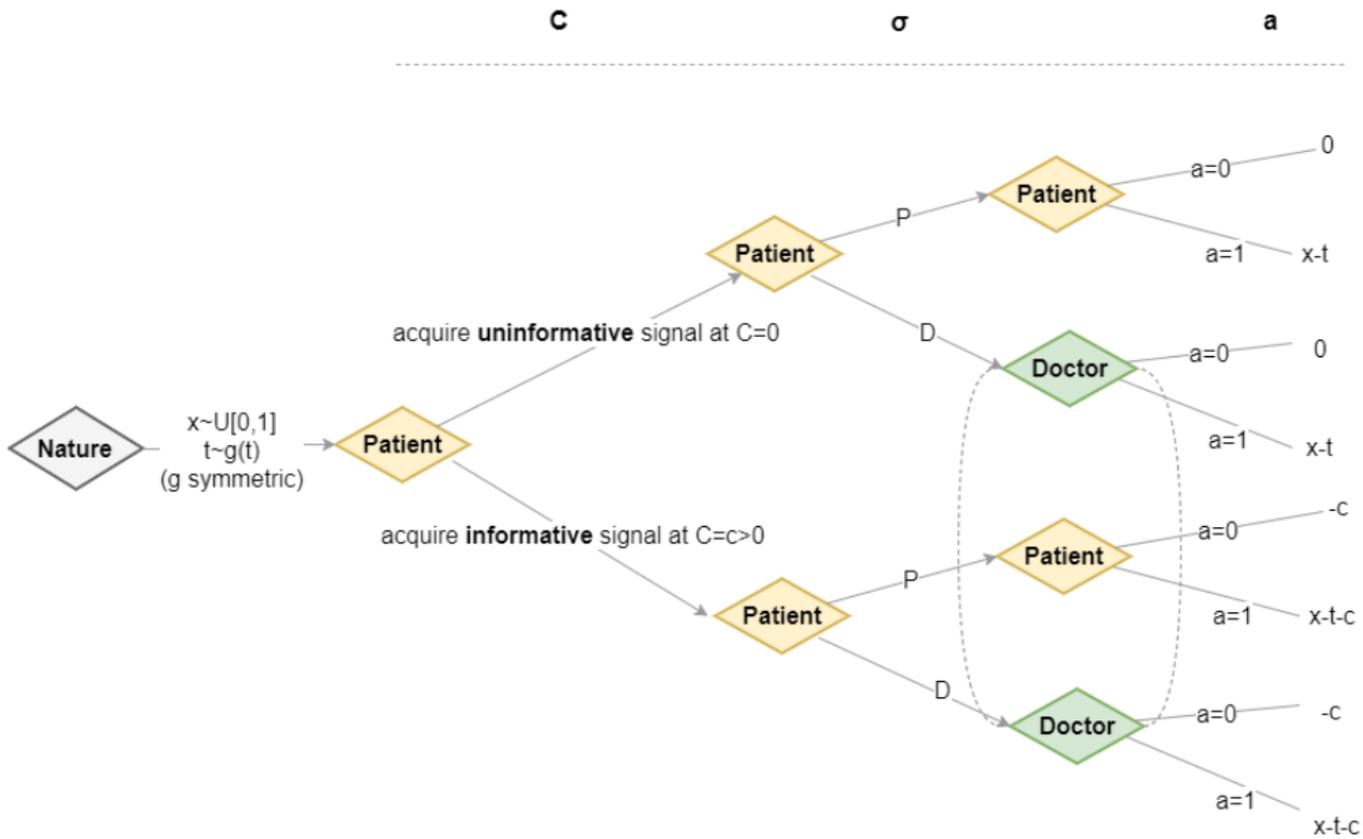
Friction 1: t is patient's **tacit knowledge** and **cannot** be expressed in language.

Friction 2: information about x **can** be acquired, but is **imperfect and costly**.

- translating medical knowledge to everyday language is hard
- time/mental cost (effort)
- signal s about x is binary

For now... think about the signal $s = \begin{cases} 1 & \text{for } x > \frac{1}{2} \\ 0 & \text{for } x < \frac{1}{2} \end{cases}$

If you're impatient... think about general class of continuous, symmetric signals with $p(x) = \mathbb{P}(s = 1|x)$ being S-shaped



Simple signal structure: $s = 1$ for $x > 1/2$ and $s = 0$ otherwise.

Assume $g(t) = U[0, 1]$ and $c < \frac{1}{36}$.

In the (unique!) equilibrium:

- patient

- invests in a signal whenever $t \in [\frac{1}{4}, \frac{3}{4}]$.
- for $t \in (\frac{5}{12}, \frac{7}{12})$ retains the authority,
- for $t \in [\frac{1}{4}, \frac{5}{12}]$ delegates for $s = 0$
- for $t \in [\frac{7}{12}, \frac{3}{4}]$ delegates for $s = 1$

- doctor

- chooses $a = 1$ (upon hearing delegation) if and only if $x \in [\frac{1}{3}, \frac{1}{2}] \cup [\frac{2}{3}, 1]$,
- thus, his recommendation is **non-monotone in health**

Limit case explained



Take doctor's choice as given:

- every patient apart from extreme gets cheap information
- median types follow the signal
- at least some types prefer to delegate
- for doctor's profile as above, the delegating types are $t \in [\frac{1}{4}, \frac{5}{12}] \cup [\frac{7}{12}, \frac{3}{4}]$.

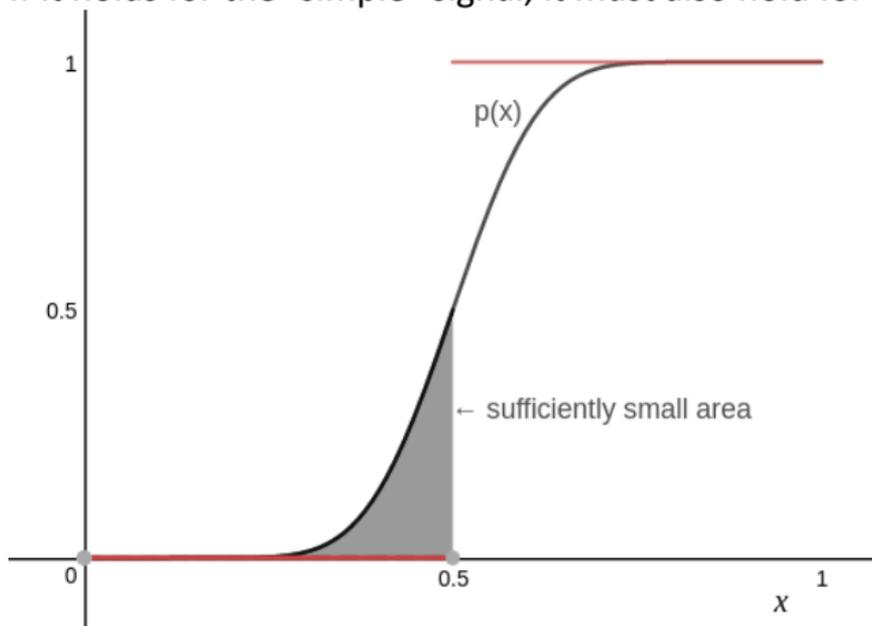
Take patient's choice as given.

- upon delegation, the doctor anticipates $t \in [\frac{1}{4}, \frac{5}{12}] \cup [\frac{7}{12}, \frac{3}{4}]$
- *but* he also know x ! Suppose $x > 1/2$
- the signal *must have been* $s = 1$
- the delegation *must have come from* $t \in [\frac{7}{12}, \frac{3}{4}]$
- on average $E(t|delegation, x) = 2/3$
- if $x < 2/3$, doctor recommends $a = 0$; otherwise $a = 1$

General result



If it holds for the "simple" signal, it must also hold for its approximations...



S-shaped functions are "approximations" of a simple signal

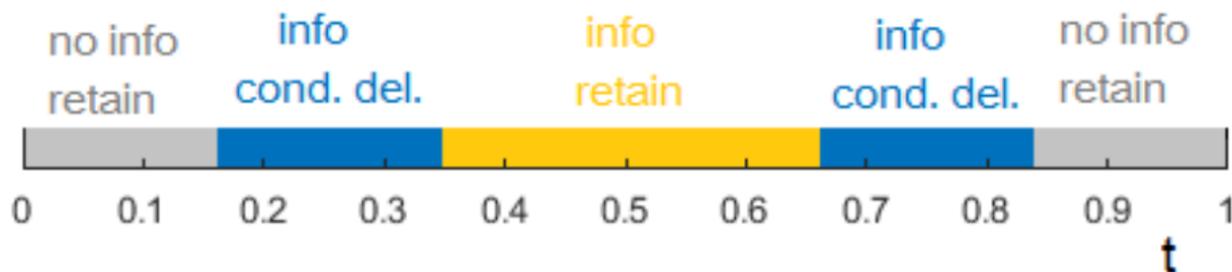
Result in a nutshell

If the signal is S-shaped and "sufficiently informative", the doctor's actions choice is non-monotone in health.

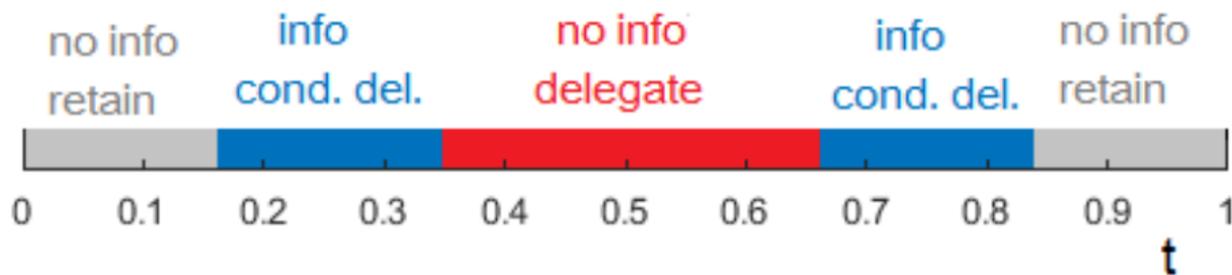
Patient's choice



Delegation & investment when information is very cheap ($c < \psi$)



...and a bit more expensive ($\psi < c < \phi$)

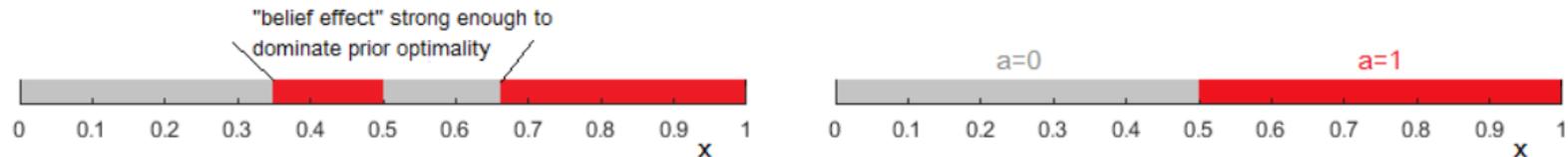


Doctor's choice



Doctor, upon delegation

- anticipates what values of (s, t) led to delegation
- knows $x \Rightarrow$ knows "most likely" s
- separates types who delegate for $s = 1$ from those who delegate for $s = 0$
- knows "most likely" range of t
- adjusts his action by choosing $a = 1$ if $x - E(t|D, x) > 0$
- choice (sometimes) is *non-monotone* in x !



Action profile if $p(x)$ is steep enough (left) and otherwise (right).

Model of costly communication vs. delegation with **no conflict of interest** and severe language frictions.

- tacit knowledge
- imperfect technology of acquiring information

Result: There exists an equilibrium with "cues", in which:

- doctor uses observed delegation *and* knowledge about x to **correctly guess the range of t**
- thus, **delegation** becomes an imperfect **signal** about the nonverbalizable type
- (for some family of signals) the action profile becomes **non-monotone** in state of the world

THANK YOU

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