

Muddy Children Problem

- N children, playing $\swarrow$ / dishy
- Some get mud on their foreheads
- $\hookrightarrow$ k
- A guardian comes and says $\rightarrow$

① "Some of you are dirty"

① → raise your hand if you are dirty

② repeat . . .

③

④ → all k children raise hands

Suppose $L > 1$

- the statement → "Some of you are dirty" — is not needed ↗
- guardian does not say ↗
- keeps asking for hand raising
- ?

Knowledge $\rightarrow$ facts

$\downarrow$

fact $- \varphi \rightarrow \varphi = \varphi_1 \vee \varphi_2 \vee \varphi_3$

$D(\varphi) \rightarrow$ distributed knowledge

$S(\varphi) \rightarrow$ existential "

$\rightarrow$ somebody knows

$E(\varphi) \rightarrow$ universal knowledge

$E(q) \rightarrow$ everyone knows q

$\rightarrow$ does everyone know that everyone knows q ?

$E^2(q) \rightarrow$ everyone knows that everyone " q

$E^3(q) \rightarrow$ ev. knows that ev knows that ev knows q

$E^{\infty}(\varphi) \rightarrow \text{Common Knowledge}$

if there are k dirty children

— $\varphi \rightarrow$ someone is dirty

$\underline{k=1}$ level of knowledge $E^0(\varphi)$

$k=2$

1

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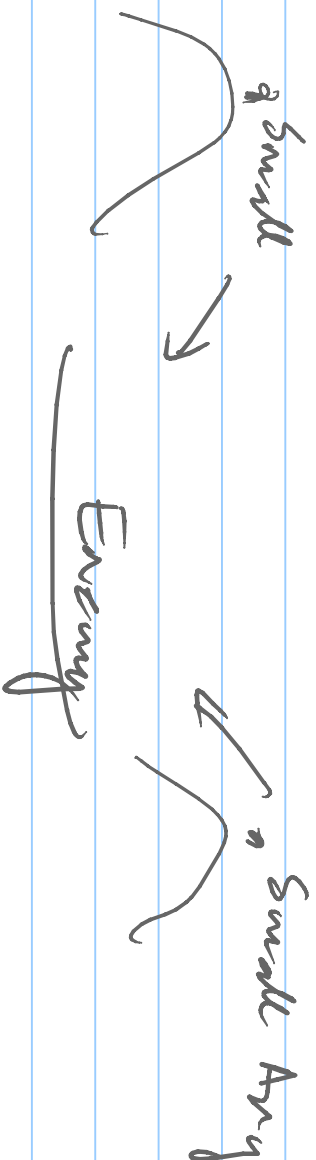
$E(\varphi)$

• $E^k(\varphi)$ is needed if k dirty children

• Observation leads to $E^{k-1}(\varphi)$

→ public statement raises the knowledge level ~~to~~ from $E^{k-1}(\varphi)$ to $E^\infty(\varphi)$

- Cheating husbands problem →
- Coordinated attack problem



Alice

Email

pls ack

Bob

Dinner
at 7

ack

pls ack

ack

→ impossible

problem is 'consensus'

↳ everyone agrees

↳ everyone knows that

everyone agreed

↳ etc

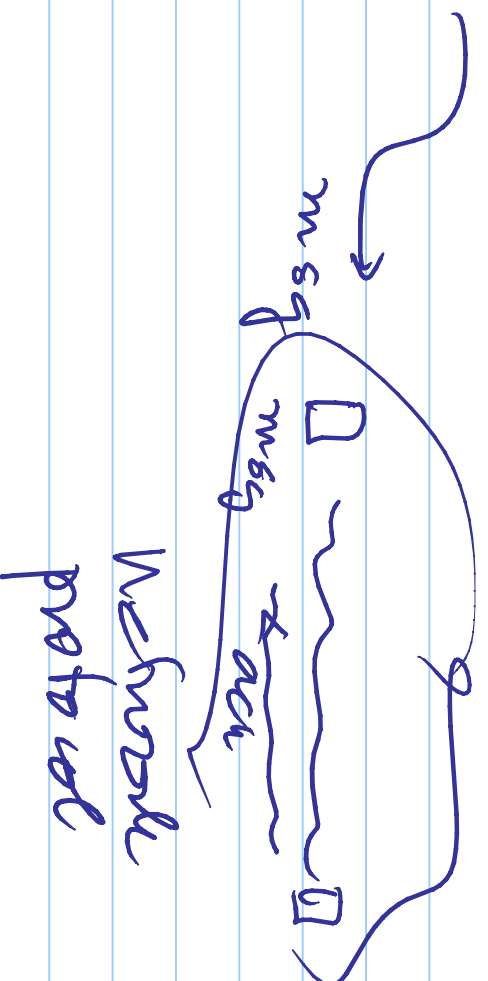
"side tone"

↳ the speaker's voice is
purposely fed back to the
speaker

Sender

?

Receiver



Must have consensus

→ cannot assume msg are ~~to~~ guaranteed

→ also failures happen (at either end)

Bank A

$\xrightarrow{\$x}$
account P

Bank B

$\longrightarrow$
account Q

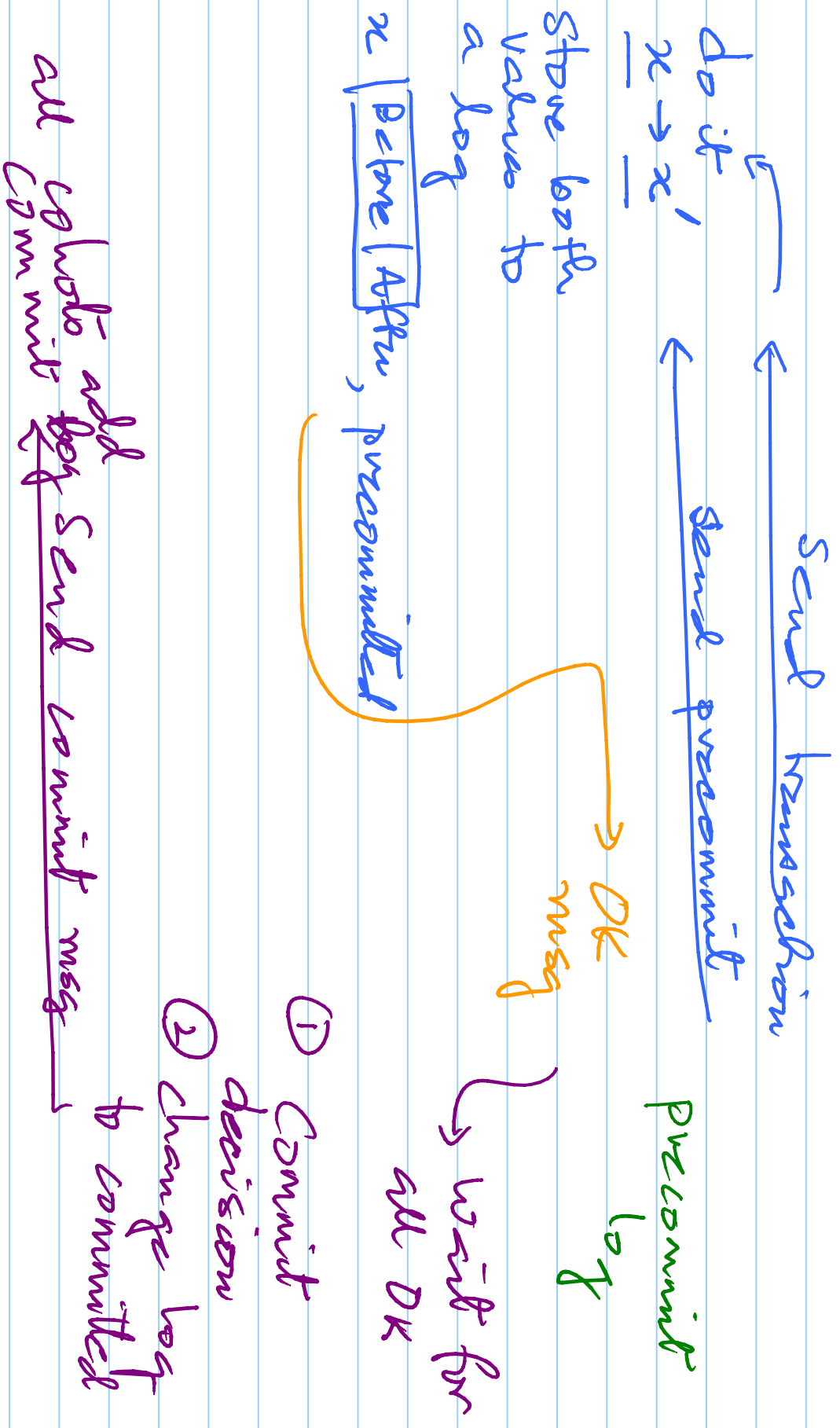
P-x

Q+x

Transactions $\rightarrow$ Atomicity $\rightarrow$ all or nothing
2-phase-commit

Cohort (1 or more)

- Coordination ①



Pre *



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about

