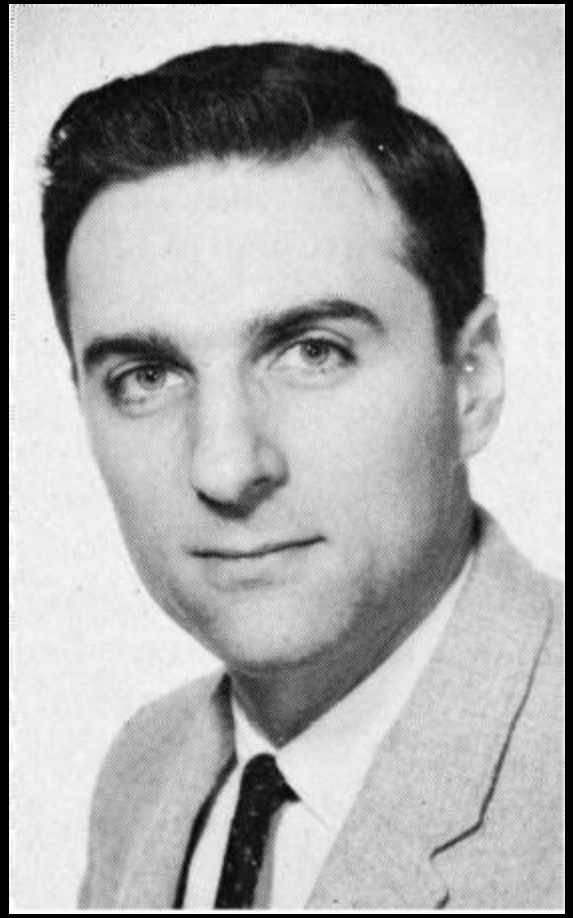
Conway's Four Laws

Mike Amundsen
@mamund

Mel Conway



Mel Conway

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- UNCOL (universal compiler language) 1958
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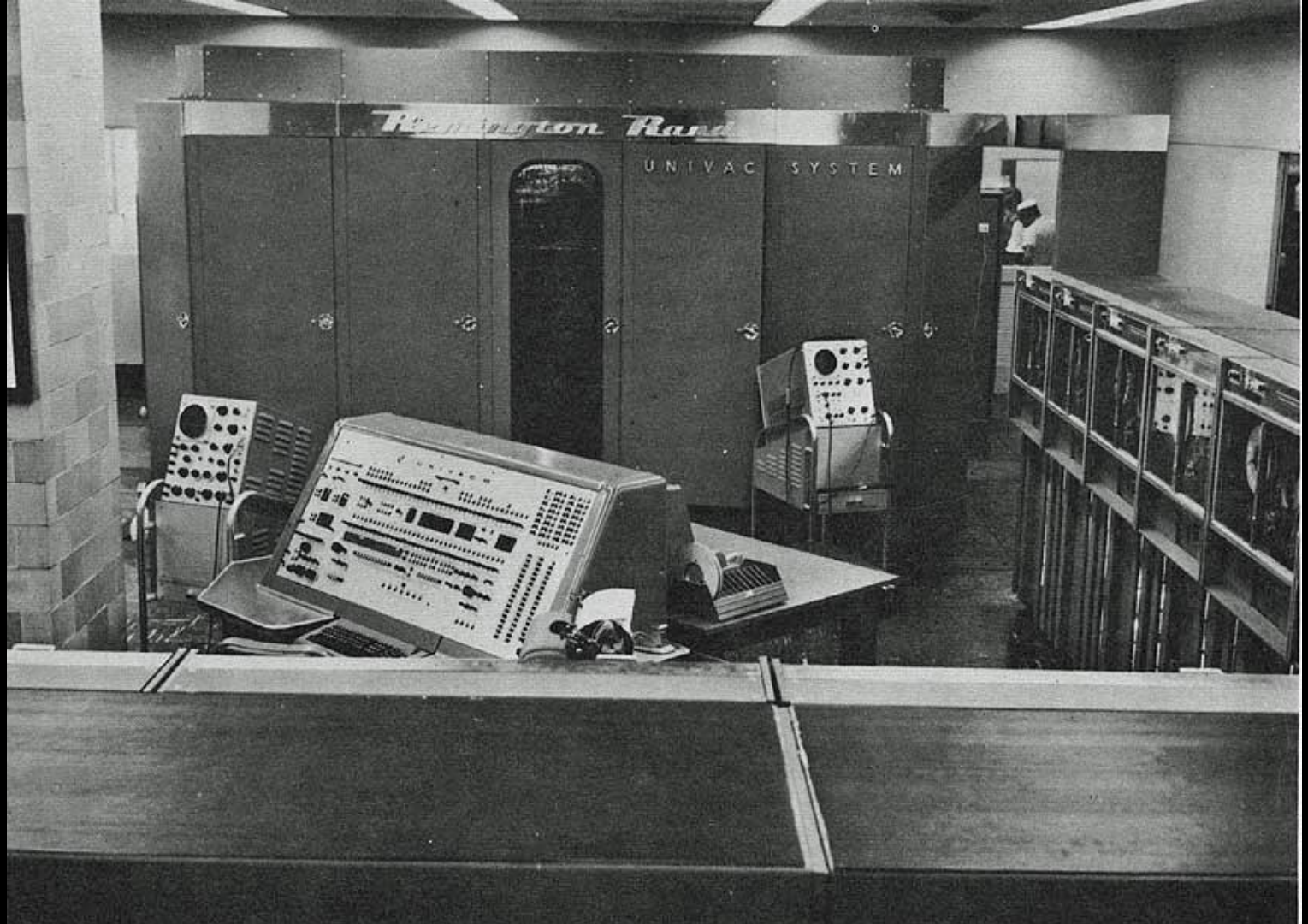
Remington Rand
UNIVAC SYSTEM

HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

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stages of design

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Communication dictates design.

-- Mel Conway, 1967

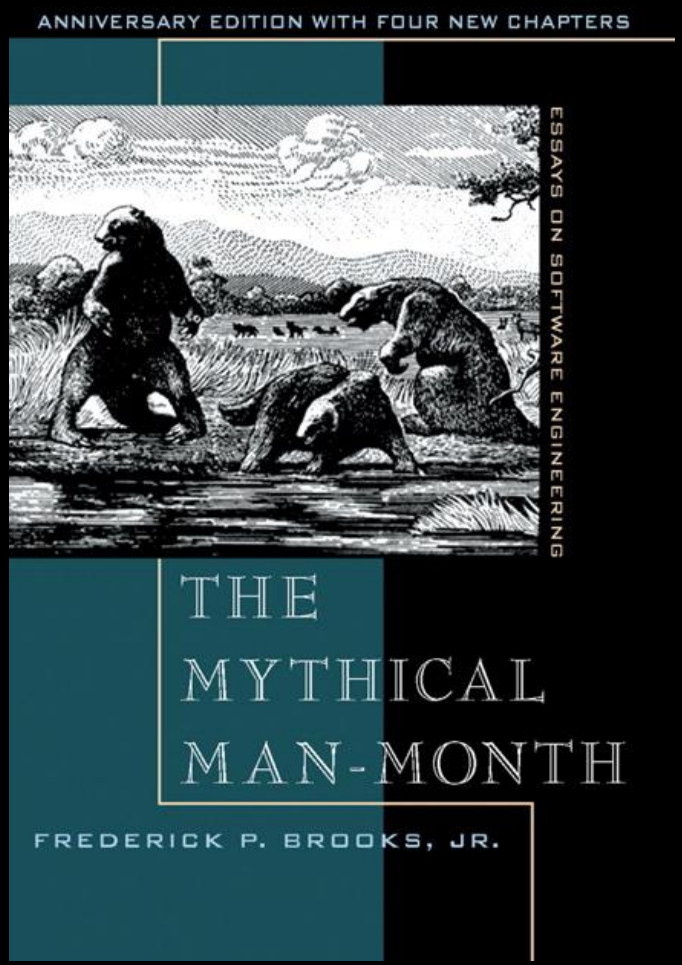
Conway's Law

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS

ESSAYS ON SOFTWARE ENGINEERING

THE MYTHICAL MAN-MONTH

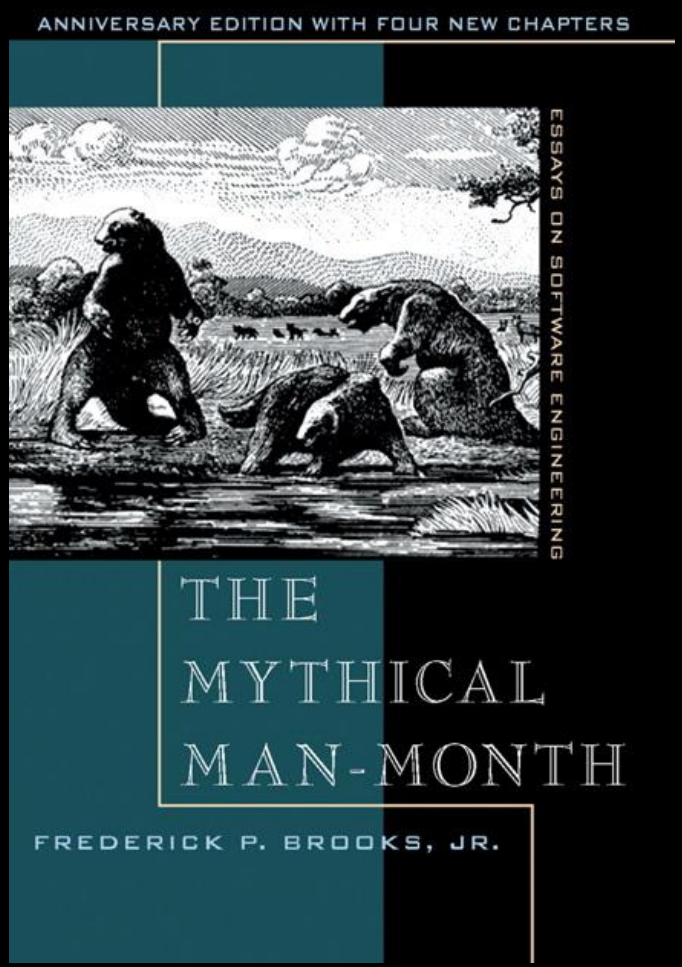
FREDERICK P. BROOKS, JR.



Brooks' Law

"*Adding manpower to a late software project makes it later*."

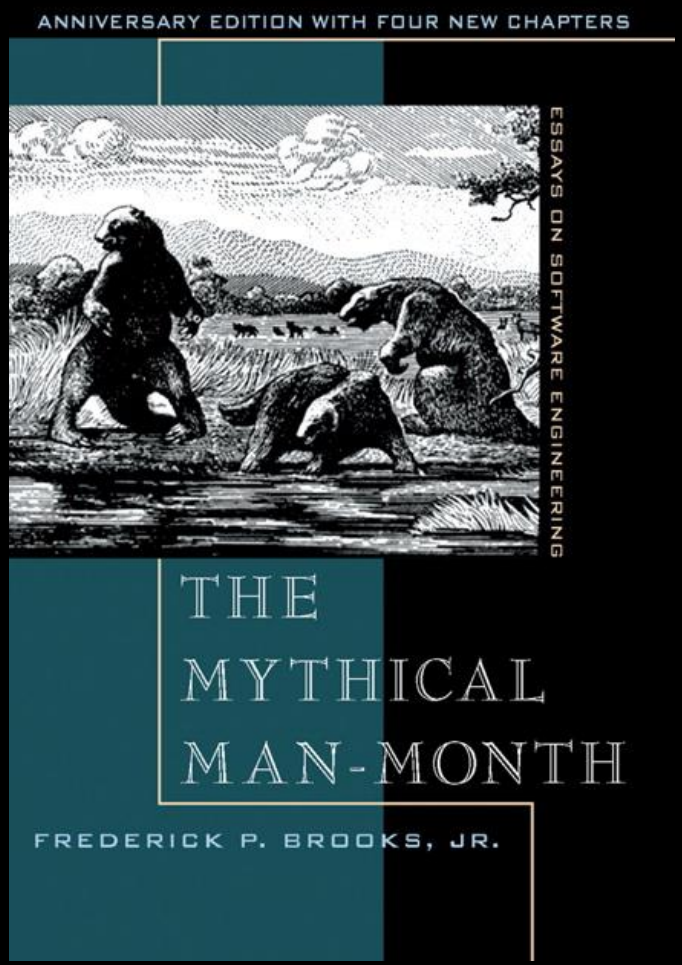
-- Fred Brooks, 1975



Intercommunication formula

$$n(n - 1) / 2$$

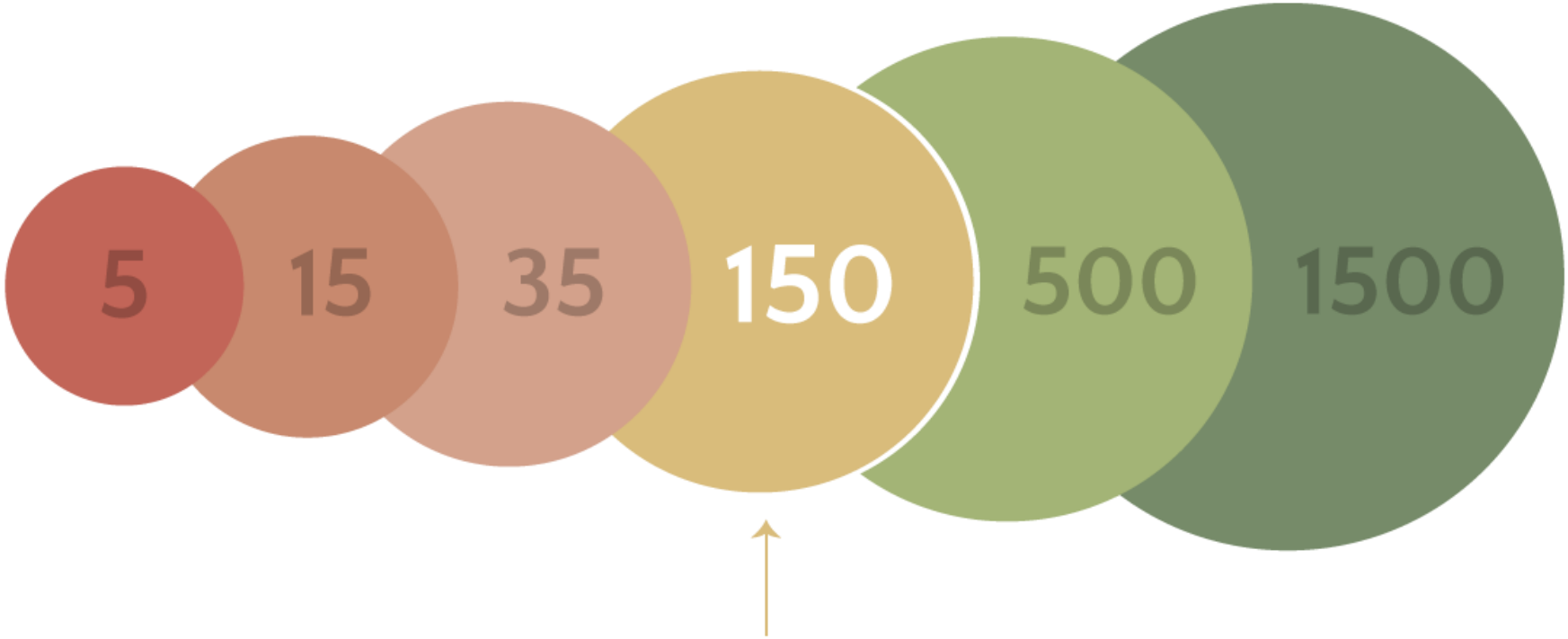
-- Fred Brooks, 1975



Intercommunication formula

```
5*(5–1)/2 = 10
15*(15–1)/2 = 105
50*(50–1)/2 = 1,225
150*(150–1)/2 = 11,175
```

-- Fred Brooks, 1975



Dunbar's Number

the max number of relationships a person can maintain

Dunbar Groups

Intimate friends: 5
Trusted friends: 15
Close friends: 35
Casual friends: 150

-- Robin Dunbar, 1992

Conway's (first) Law
tells us TEAM SIZE is important

so…
Make the teams as small as necessary.

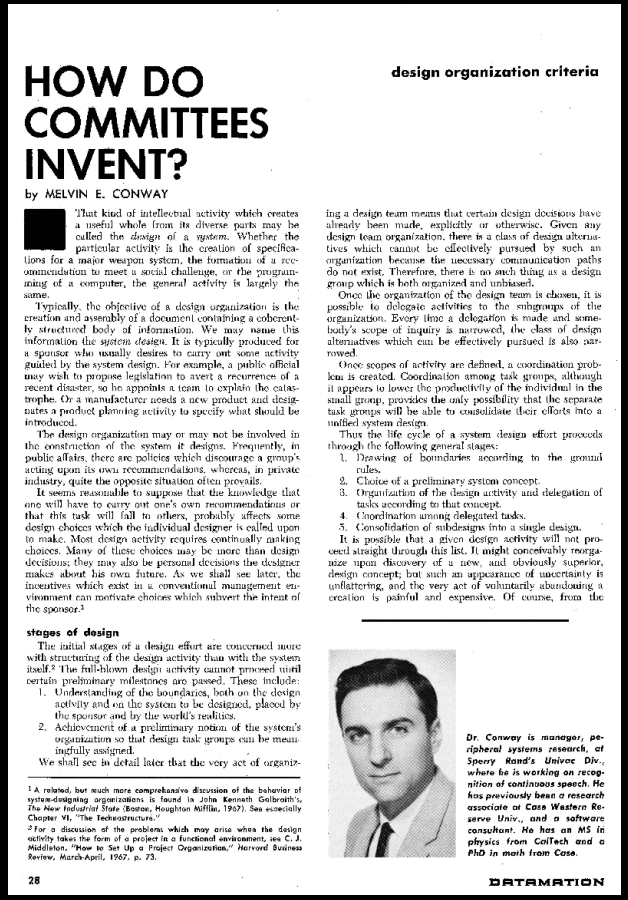
ASSESSMENT:

If you don't have
a personal relationship
with every member of your TEAM,
your team is probably TOO BIG.

GUIDANCE:

Aim for TEAM SIZE
of “Dunbar level 1” (5),
possibly “Dunbar level 2” (15).

So… what about other Conway Laws?



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Doing it Over

"There is never enough time to do something right, but there is always enough time to do it over."

-- Mel Conway, 1967

The ETTO Principle:

Efficiency-Thoroughness Trade-Off

Why Things That Go Right Sometimes Go Wrong

ERIK HOLLNAGEL

Increasing Intractability

1. Systems grow too large
2. Rate of change increases
3. Overall expectations keep rising

-- Eric Hollnagel, 2009

Conway's Second Law
tells us PROBLEM SIZE is important

so…
Make the solution as small as necessary.

ASSESSMENT:

If you (or your team)
cannot explain ALL the code
in your release package,
your release is TOO LARGE

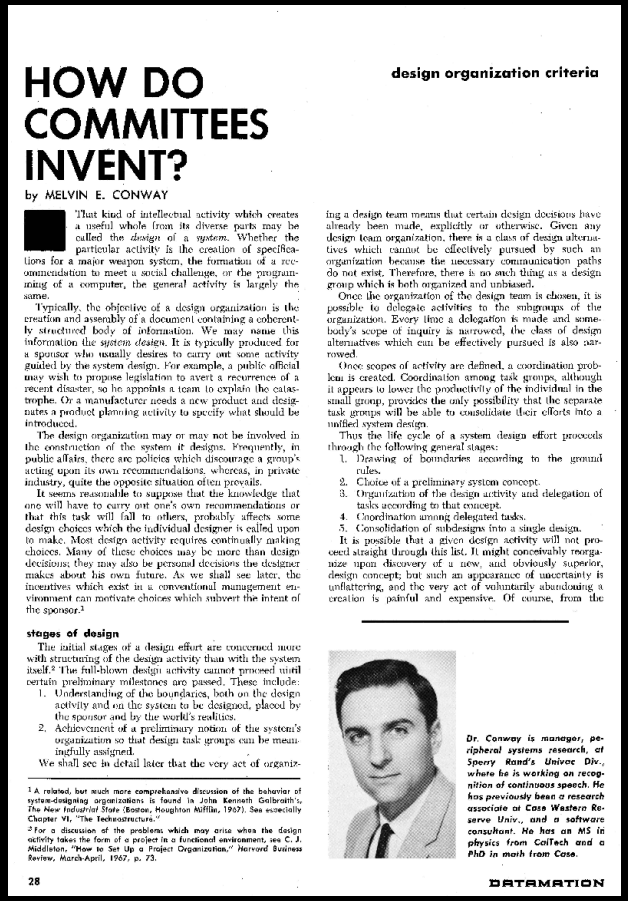
GUIDANCE:

Execute many SMALL releases instead of a few LARGE releases.

Homomorphism

"There is a homomorphism from the linear graph of a system to the linear graph of its design organization"

-- Mel Conway, 1967



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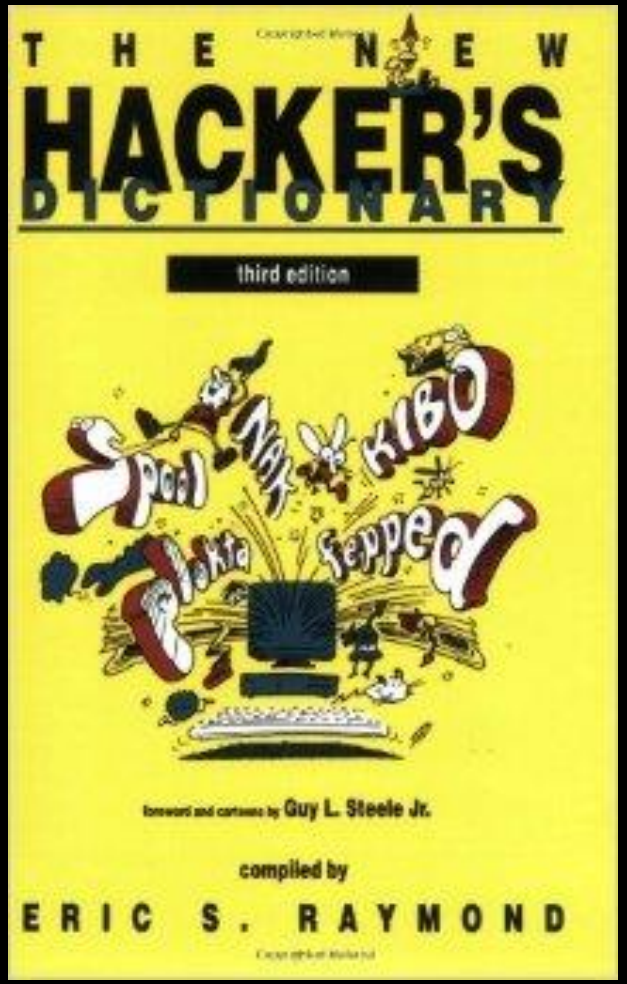


Homomorphism

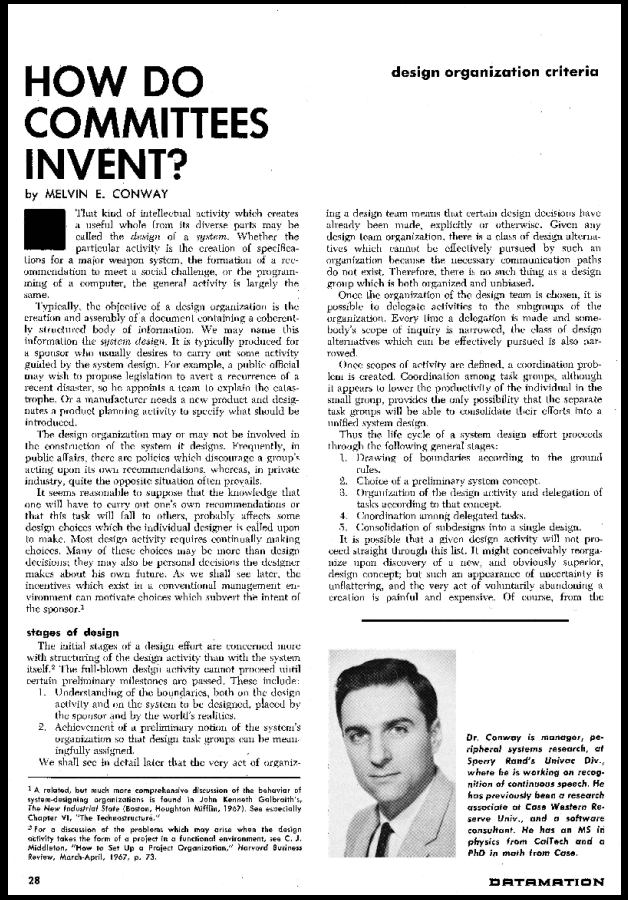
“If you have four groups working on a compiler, you'll get a 4-pass compiler.”

- Eric S. Raymond, 1991

Conway's Third Law
tells us CROSS-TEAM INDEPENDENCE
is important.

So…
Make each team fully independent.

If you have to hold a release until some other team is ready, you are not an INDEPENDENT TEAM



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Disintegration

"The structures of large systems tend to disintegrate during development, qualitatively more so than with small systems."

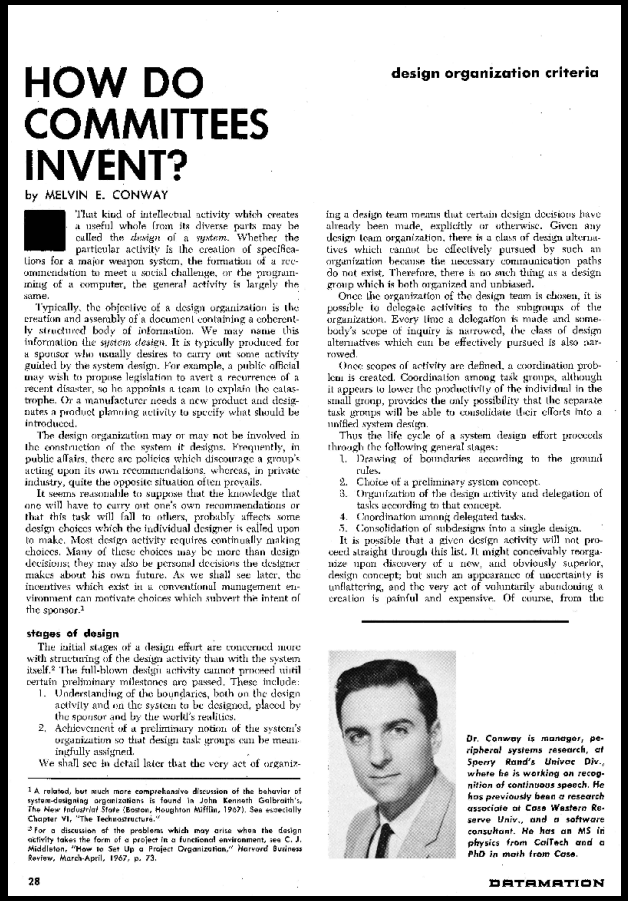
-- Mel Conway, 1967

Three reasons Disintegration occurs…

Disintegration: Reason #1

“The realization that the system will be large, together with organization pressures, make irresistible the temptation to assign too many people to a design effort”

-- Mel Conway, 1967



design organization criteria

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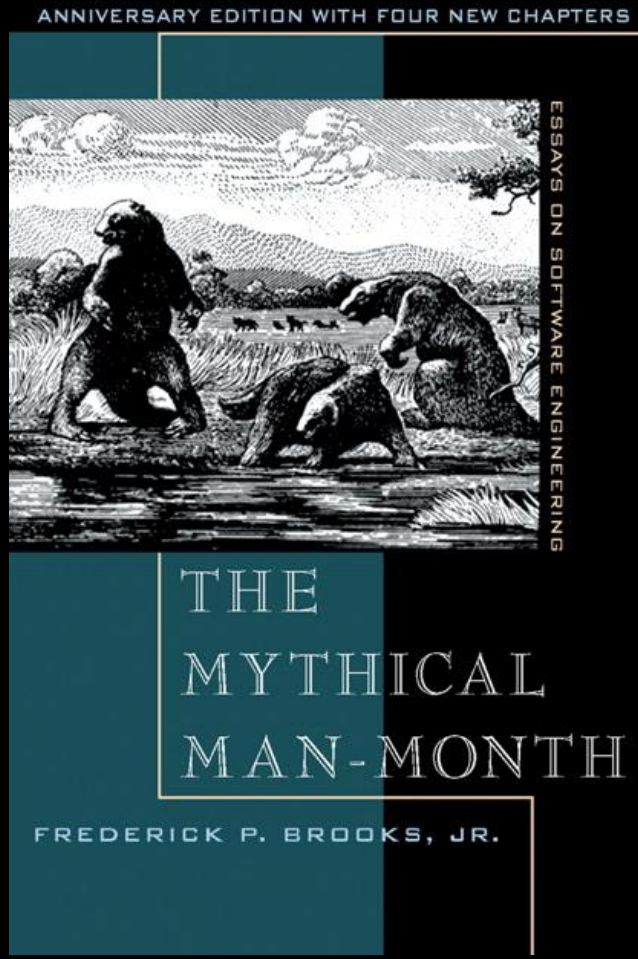

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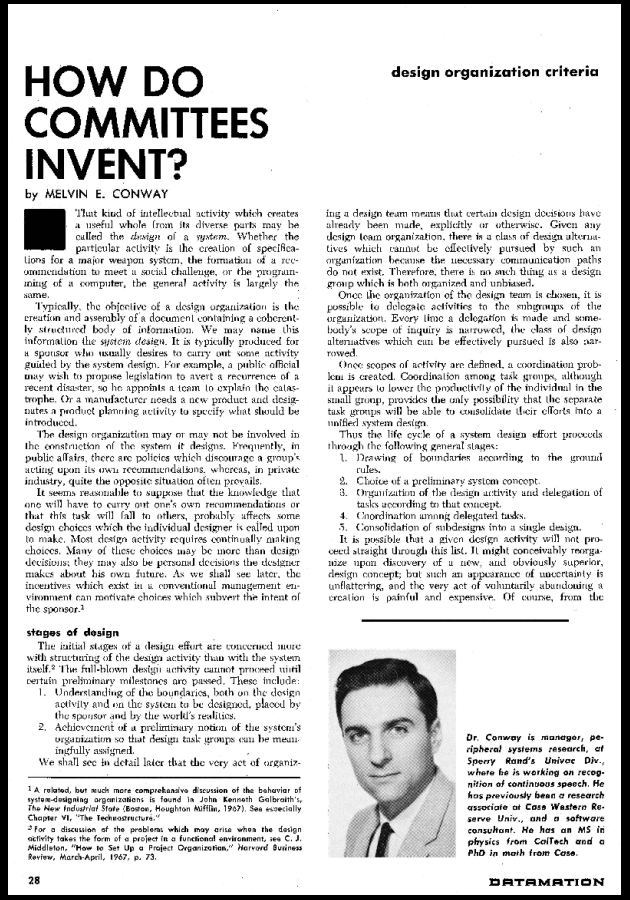
Adding manpower to a late software project makes it later.

-- Fred Brooks, 1975

Disintegration: Reason #2



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stages of design

The initial stages of a design effort are concerned more with structuring of the design activity than with the system itself.[2] The full-blown design activity cannot proceed until certain preliminary milestones are passed. These include:

1. Understanding of the boundaries, both on the design activity and on the system to be designed, placed by the sponsor and by the world's realities.
2. Achievement of a preliminary notion of the system's organization so that design task groups can be meaningfully assigned.

We shall see in detail later that the very act of organizing a design team means that certain design decisions have already been made, explicitly or otherwise. Given any design team organization, there is a class of design alternatives which cannot be effectively pursued by such an organization because the necessary communication paths do not exist. Therefore, there is no such thing as a design group which is both organized and unbiased.

Once the organization of the design team is chosen, it is possible to delegate activities to the subgroups of the organization. Every time a delegation is made and somebody's scope of inquiry is narrowed, the class of design alternatives which can be effectively pursued is also narrowed.

Once scopes of activity are defined, a coordination problem is created. Coordination among task groups, although it appears to lower the productivity of the individual in the small group, provides the only possibility that the separate task groups will be able to consolidate their efforts into a unified system design.

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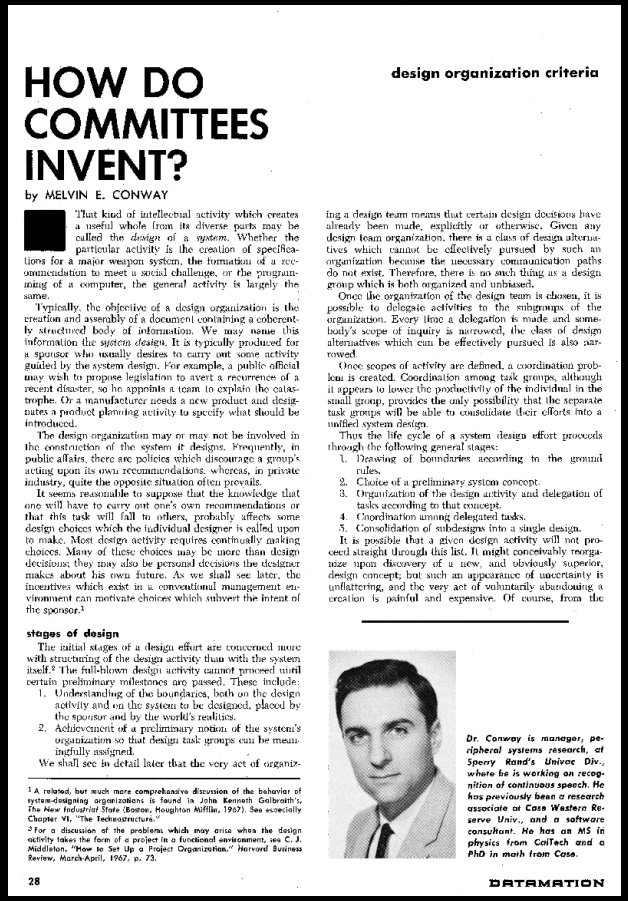
"Application of the conventional wisdom of management to a large design organization causes its communication structure to disintegrate."

-- Mel Conway, 1967

Dunbar's Number

A measurement of the "cognitive limit to the number of individuals with whom any one person can maintain stable relationships."

-- Robin Dunbar, 1992



HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

That kind of intellectual activity which creates a useful whole from its diverse parts may be called the *design* of a *system*. Whether the particular activity is the creation of specifications for a major weapon system, the formation of a recommendation to meet a social challenge, or the programming of a computer, the general activity is largely the same.

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Disintegration: Reason #3

"Homomorphism insures that the structure of the system will reflect the disintegration which has occurred in the design organization."

-- Mel Conway, 1967

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Communication dictates design.

-- Mel Conway, 1967

Conway's Fourth Law
tells us TIME is against LARGE teams.

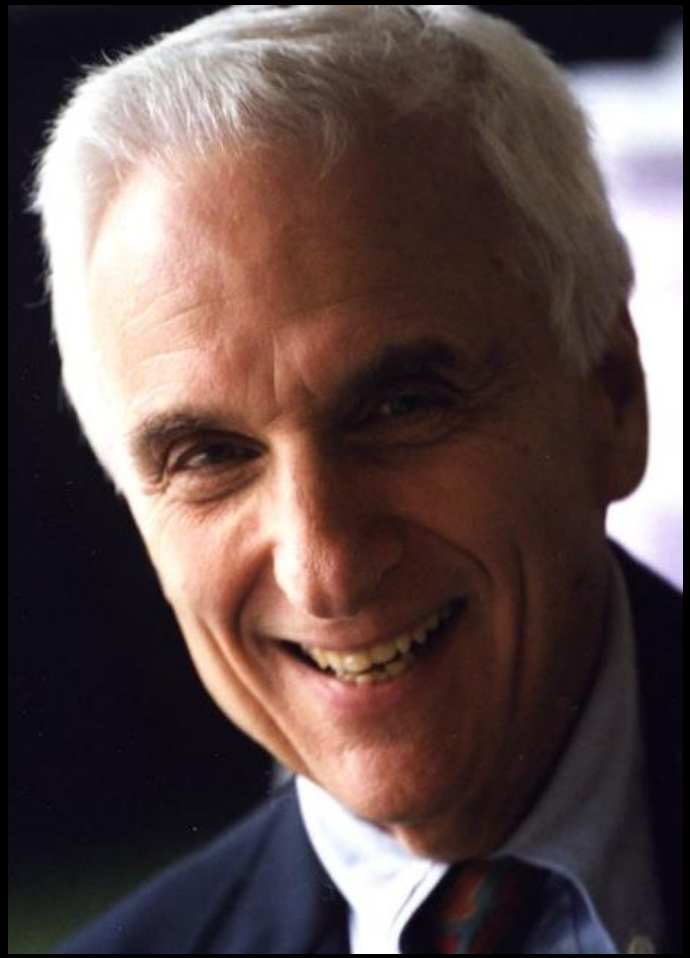
So…
Make release cycles short and small.

ASSESSMENT:

If your release dates are often missed, your SCOPE is TOO BIG.

GUIDANCE:

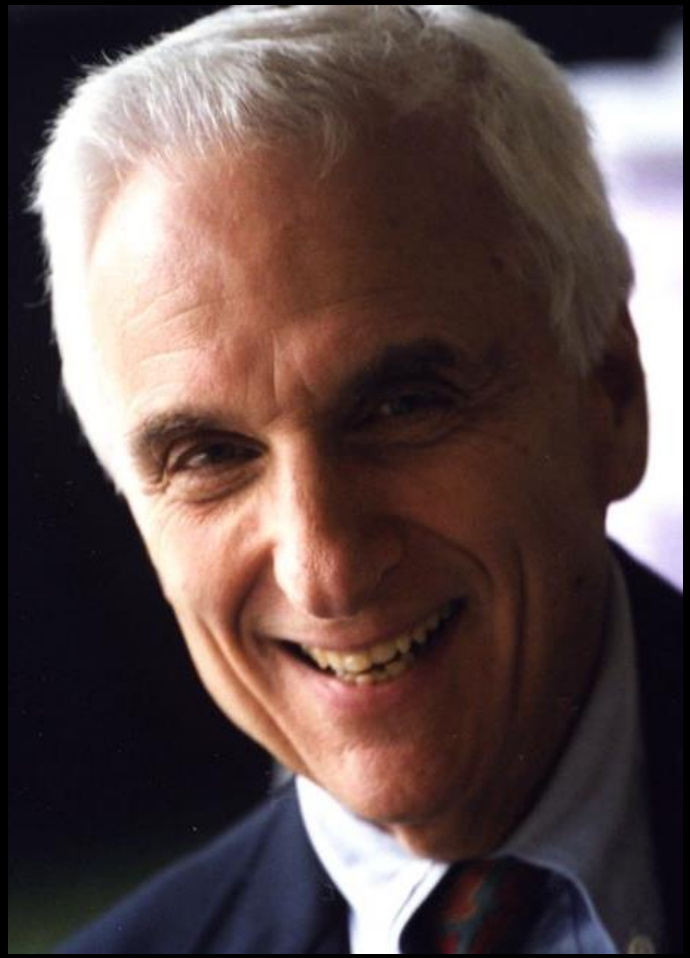
Aim for a SCOPE that supports a release cycle of two weeks or less.



Conway's First Law

A system's design is a copy of the organization's communication structure.

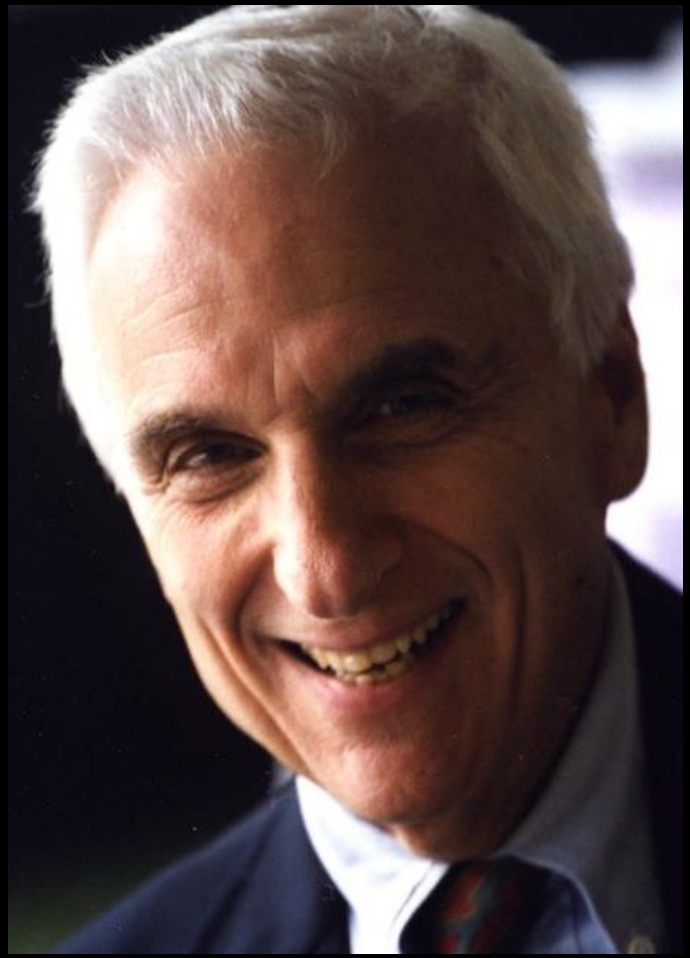
Actively manage communications within the teams and across teams.



Conway's Second Law

There is never enough time to do something right, but there is always enough time to do it over.

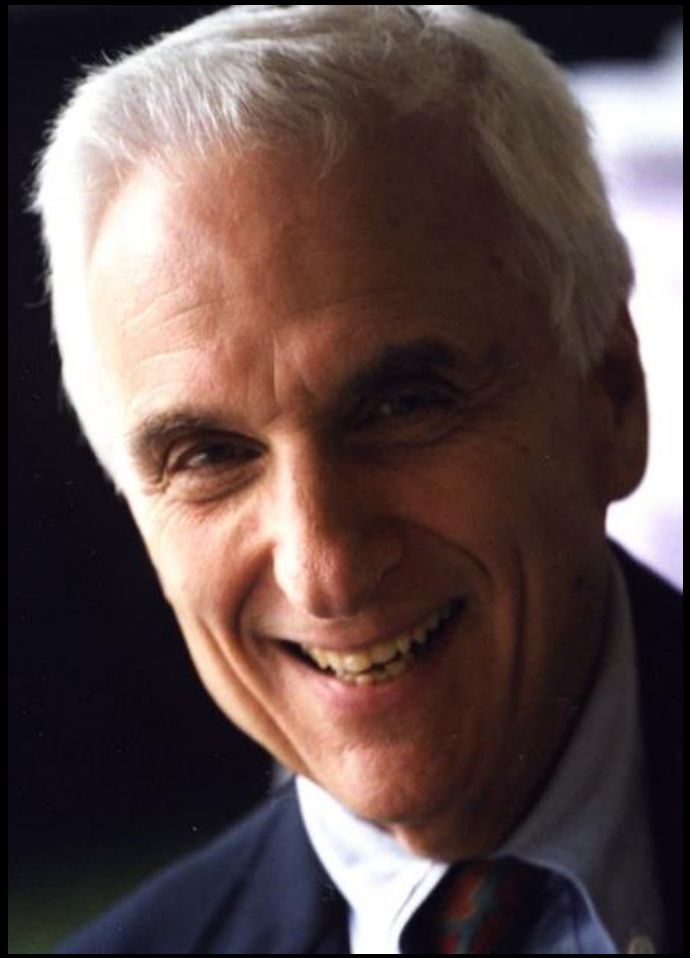
Remember the process is continually repeating.



Conway's Third Law

There is a homomorphism from the linear graph of a system to the linear graph of its design organization.

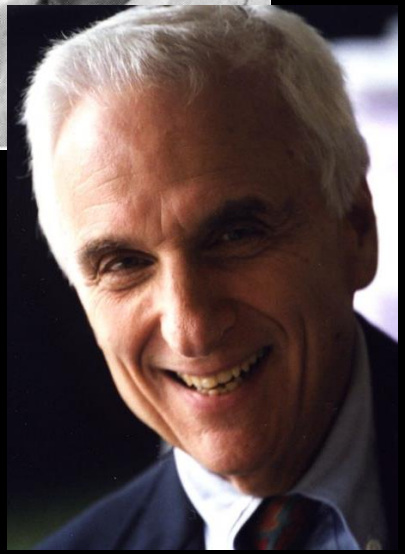
Organize teams in order to achieve desired system.



Conway's Fourth Law

The structures of large systems tend to disintegrate during development.

Keep your teams as small as necessary, but no smaller.



Conway's Lessons from 1967

1. Increase communications
2. Support continuous process
3. Organize teams by products
4. Make teams small as necessary

Conway's Four Laws

Mike Amundsen
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