

# Conway's Law at a Distance

*Building Teams in a Distributed World*

Mike Amundsen  
CA Technologies  
@mamund





# Cover slide : Barn Raising

*A collective action in which a barn for one of the members is built by all the members of the community.*

*- Wikipedia*

# Introduction



Mike Amundsen  
@mamund



Search API Academy

- API Strategy
- API Design
- API Management
- Resources
- About



Register Sign In

# Your Guide to API Design & Implementation Best Practices

API Academy delivers free online lessons and in-person consulting services covering essential API techniques and tools for business managers, interface designers and enterprise architects



### What is an API?

Get an overview of what an API is and what it does, to help you realize the business value of APIs



### API Design Basics

Understand the API architecture process and learn basic design and implementation best practices



### Web API Architectural Styles

Get a detailed overview of the main architectural styles for Web and mobile API design



### Choosing a Solution

Choose between the various solutions that offer the basic components for enterprise API Management

*Creating Evolvable Hypermedia Applications*



*Building*

# Hypermedia APIs with HTML5 & Node

O'REILLY\*

*Mike Amundson*

*Creating Evolvable Hypermedia Applications*



*Building*

# Hypermedia APIs with HTML5 & Node

O'REILLY\*

*Mike Amundsen*

*Services for a Changing World*

# RESTful Web APIs



O'REILLY\*

*Leonard Richardson,  
Mike Amundsen & Sam Ruby*



*Creating Evolvable Hypermedia Applications*



*Building*

# Hypermedia APIs with HTML5 & Node

O'REILLY®

*Mike Amundsen*

O'REILLY®



# Designing APIs for the Web

*Mike Amundsen*

**VIDEO**

*Services for a Changing World*

# RESTful Web APIs



O'REILLY®

*Leonard Richardson,  
Mike Amundsen & Sam Ruby*

# Conway's Law

# Conway's Law at a Distance

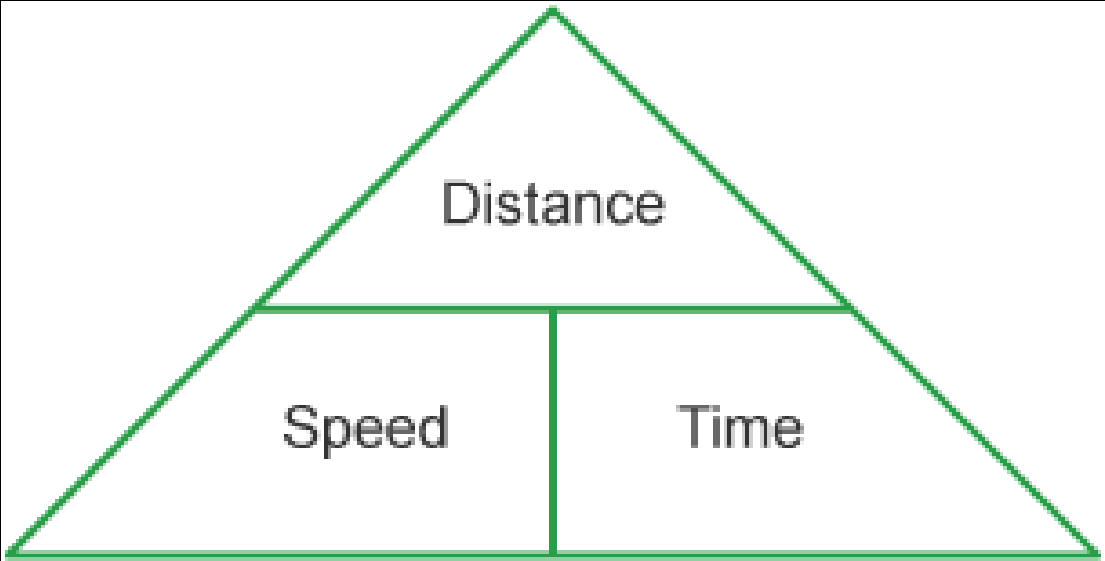
# 11,766 km

Distance from China to  
Kentucky











Distance

Speed

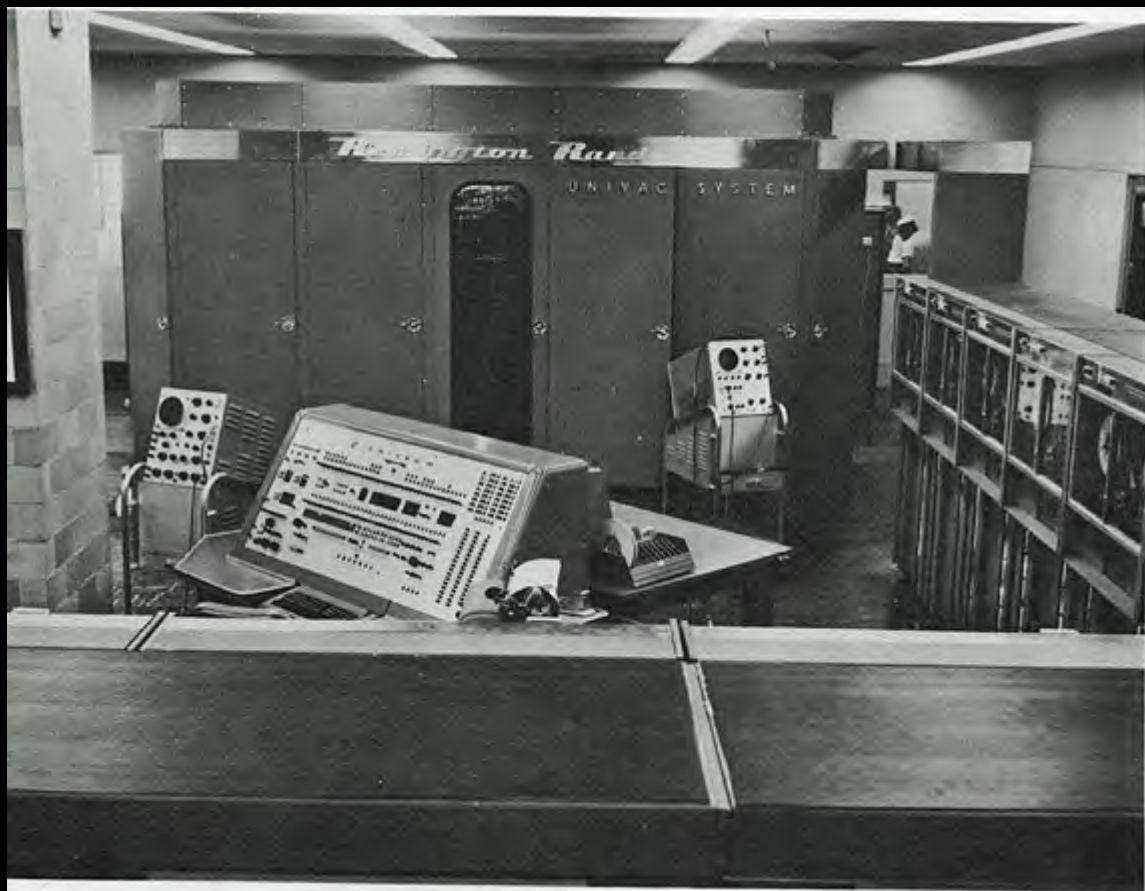
Time





**Melvin Conway**





# ***Project-Based Organizations***



*“Project-based organizations revolve around the concept that a group of individuals or firms join together with the explicit purpose of producing a tangible set of outputs”*

*-- Paul Chinowsky, EPOJ 2011*

***“How Do Committees Invent?”***

1967

John Kenneth  
Galbraith

The  
NEW  
INDUSTRIAL  
STATE

With a new foreword by  
**James K. Galbraith**



*James Madison*

JAMES MADISON LIBRARY  
IN AMERICAN POLITICS

# ***Technostructure***

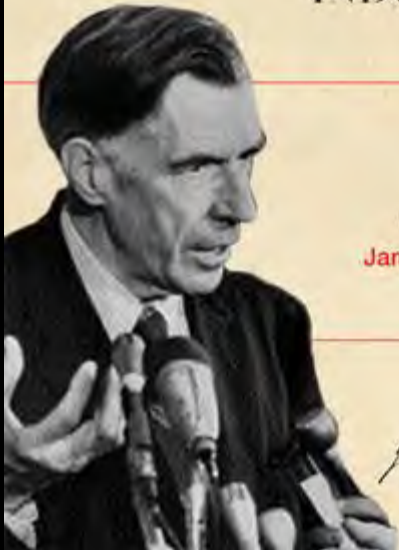


1967

John Kenneth  
Galbraith

The  
NEW  
INDUSTRIAL  
STATE

With a new foreword by  
James K. Galbraith



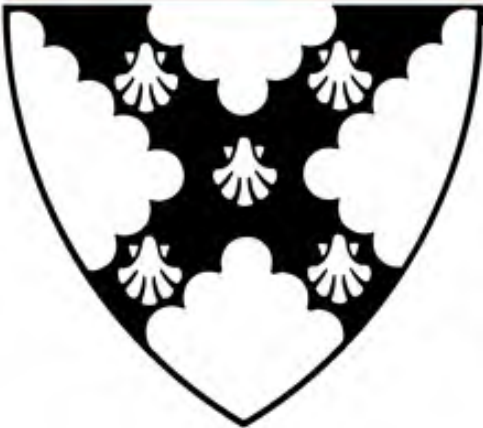
*James Madison*  
JAMES MADISON LIBRARY  
IN AMERICAN POLITICS

# *Technostructure*

*The group of technicians  
within an enterprise with  
considerable influence and  
control.*

*-- John Kenneth Galbraith*

***“How Do Committees Invent?”***



# Harvard Business Review

**REJECTED**

# DATAMATION

Vol. 11 No. 11 NOVEMBER 1978

WORLDWIDE INDUSTRY  
THE DATAMATION

100

## HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

**B**ut how do committees invent, which means a model which has no direct prior may be called the design of a system. Whether the particular industry is the analysis of specifications for a mass weapon system, the formation of a communications to meet a social challenge, or the reconstruction of a coastline, the general problem is largely the same.

Typically the objective of a design committee is the creation and assembly of a function conceived a concept, by abstracted levels of information. We may assume that information is the design output. It is typically generated for a system who usually change or vary over some activity related by the system design. For example, a public official may work to prepare legislation to meet a restriction of a national statute, or to provide a loan to exploit the committee. In a manufacturing world a new product and distribution product planning activity to specify what should be introduced.

The design responsibility may be more or less limited to the possession of the system. It begins, therefore, or provide within they are persons who generate a group coming after its own interdependence, internal, or external, quite the opposite of the system's overall.

It seems reasonable to suggest that the knowledge that one will learn in every job one's own interdependence is that this job will call for others' knowledge, ability, and design choices which the individual designer is called upon to make. Most design activity requires essentially solving problems. Many of these choices may be made from design committee. They also are generated through the interaction of the team design. As we shall see later, the committee which exist in a conventional management environment are not those which reduce the design of the system.

### stages of design

The design stages of a design effort are measured either with respect to the design activity from the design team itself. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Understanding of the background, both in the design activity and in the system to be designed, placed by the designer and by the world's reality;
2. Achievement of a preliminary outline of the system's functionality of that design the groups can be made, specifically assigned.

As will be recalled later that the very act of design-

### design organization criteria

ing a design team means that various design elements have already been made, rights to resources. Given any design interdependence there is a class of design alternatives which cannot be effectively generated for such an organization because the necessary communication paths do not exist. Therefore there is an early stage of a design activity which is both required and critical.

Given the requirements of the design team it is possible to design committee by the composition of the organization. Every time a designer is made and someone's scope of activity is assigned, the design of design alternatives which can be effectively generated is also assigned.

The scope of activity is defined, a coordination problem is created. Coordination among task groups, although it appears to have the benefits of the individual in the design group provides the only possibility that the information groups will be able to coordinate their efforts into a unified system design.

Thus the size and of a system design often proceed through the following general steps:

1. Defining of boundaries according to the present state;
2. Clarification of the preliminary system concept;
3. Organization of the design activity and assignment of tasks according to that concept;
4. Coordination among individual tasks;
5. Coordination of subdesigns into a single design.

It is possible that a more design activity will not proceed without design that are. It might conceivably regenerate sign discovery of a type, and effectively generate design concepts for each an organization of necessity it collecting, and the very act of effectively collecting a resource is, parallel and separate. It comes, from the



Dr. Conway is manager, applications systems research, of Texas A&M's Oliver Division, where he is working on requirements of maintenance hardware. He has previously held a research position at Case Western Reserve Univ., and is software consultant. He has an M.S. in physics from Caltech and a Ph.D. in such from Case.

1. A related but much more comprehensive discussion of the behavior of interdependent organizations is found in my book, *Unplanned Change: The Way We Work* (New York: Harper & Row, 1971). See especially Chapter 10, "Interdependence."

2. For a discussion of the problem which may arise with the design activity that the form of a system is a functional interdependence, see C. J. Gallwey, "How to Use a Design Department," *Harvard Business Review*, September 1969, p. 78.

“

Any organization that designs a system (defined more broadly here than just information systems) will inevitably produce a design whose structure is a copy of the organization's communication structure.”

-- Mel Conway, 1967

## HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of professional survey which means a small circle from an obvious point may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a communication to meet a social challenge, or the organization of a committee, the general activity is design.

Typically, the objective of a design organization is the creative and assembly of a function concerning a collection of associated parts of information. We may name this information the design object. It is to be fully produced for its separate use, usually before any other activity related by the system design. For example, a public-affairs group may wish to prepare legislation to amend a procedure of a social function, or to provide a basis for applying the constraints of a management model to a new product and distribution procedure, or to specify a social function to be introduced.

The design organization may in some cases be identified as the organization of the system it designs. However, in practice, after the project is completed, a group consisting of the design organization, the project manager, and the sponsor of the system is needed.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own communication in that this task will call for others, probably others working through others, that the individual designer is pulled together by this. Most design activity reports continually address others. More or less, others may be used to design, especially the one also to provide the necessary data about the system. At the end of the line, the committee which must be a communication management organization to coordinate choices which reduce the level of the system.

### Stages of design

The design stages of a design when one interested with the system of the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. Some include:

1. Understanding of the objectives, both as the design activity and as the system to be designed, planned by the initiator and by the client's initiator.
2. Assignment of a preliminary index of the activity to be undertaken in that design task groups can be mutually assigned.

It is well to be reminded that the year of 1967

It is noted that with more representative discussion of the history of communication organization in design, or other related fields, the new edition of this journal, Summer 1970, has already been published. The "Introduction" of this issue, which was also the last activity, is a copy of a paper in a National Conference on C. E. Johnson, "Part in the Design of a Public Department," National Research Service, Boulder, CO, 1967, p. 15.

### design organization criteria

ing a design team design that various design functions are clearly distinguished, rights to information. Given the design organization, there is a class of design structures which cannot be effectively produced or used to separate because the necessary communication policy is not valid. Therefore there is an end to a design activity which is both organized and balanced.

Once the organization of the design team is defined, it is necessary to designate activities to the members of the organization. Every item is designed, it is used and someone's work of design is necessary, the class or group of activities which can be effectively planned is also assigned.

Thus, scope of activity is defined, a communication problem is resolved. Coordination among task groups, although necessary to have the possibility of the individual in the design group, provides the only possibility and the communication group will be able to coordinate the effort into a unified system design.

Thus the design of a system design after proceeding through the following general stages:

1. The scope of the design activity is defined, as the project is planned.
  2. Division of a preliminary design structure.
  3. Organization of the design activity and delegation of tasks according to that design.
  4. A communication among related tasks.
  5. Coordination of the design activity to a unified design.
- It is possible that a design activity will not be personally assigned to each of the system and effectively coordinate design reports, but with an assignment of necessary information, and the way to be effectively coordinated, it is necessary to provide and coordinate. It is noted, from the



Dr. Conway is currently, principal systems research of Lawrence Livermore University, Director, where he is working on organization of communication. He has previously been a research associate of Case Western Reserve University, and a software consultant. He has an MS in physics from Cornell and a PhD in math from Case.

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which seems a contradiction from its design point may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a communication to meet a social challenge, or the reorganization of a committee, the general activity is design.

Typically, the objective of a design organization is the creative and assembly of a function concerning a collection of associated fields of information. We may name this information the design matrix. It is typically produced by an agency or a committee chosen to carry out some activity related to the system design. For example, a public official may wish to propose legislation to amend a provision of a national statute. He first appoints a team to explore the consequences of a particular amendment. He then appoints a committee to study the consequences of a particular amendment. He then appoints a committee to study the consequences of a particular amendment.

The design organization may in time wish to investigate the consequences of the system it designs. It may wish to investigate the consequences of the system it designs. It may wish to investigate the consequences of the system it designs.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own communication is that this task will call for others, probably others, some design, others will be the individual designer. It is called communication. Most design activity involves continually making choices. More or less often they are made from design matrices. They are also in general decisions which are made about by two bodies. At one end we have the committee which must in a conventional management organization choose choices which reduce the level of the system.

## Steps of design

The design steps of a design when one chooses to work with a committee of the design agency that will be chosen. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, such as the design agency and the nature to be investigated, planned by the individual and by the world's reality.
2. Assignment of a preliminary matrix of the activity, responsibility in that design two groups can be made, namely assigned.

It is well to be reminded that the very act of appoint-

It is noted that with these responsibilities of the design of a communication organization is based on the design of a communication organization. The design of a communication organization is based on the design of a communication organization. The design of a communication organization is based on the design of a communication organization.

This is a reprint of the article which was first published in the design of a communication organization. The design of a communication organization is based on the design of a communication organization. The design of a communication organization is based on the design of a communication organization.

## design organization criteria

ing a design team design that creates design decisions that clearly have made, rights to or otherwise. Given any design organization there is a class of design activities which cannot be effectively produced by such an organization because the necessary communication paths do not exist. Therefore there is an such thing as a design organization which is both necessary and sufficient.

Given the organization of the design team it is possible to design activities in the organization of the organization. Every item a designer is made and some design steps of design is necessary, the class of design activities which can be effectively produced is also assigned.

These steps of activity are defined, a communication problem is created. Coordination among task groups, although it appears to have the possibility of the individual in the design group will be able to coordinate the effort of a smaller design group.

Thus the following are a design design other groups:

1. The design of the design activity in the design of the design.
2. The design of the design activity in the design of the design.
3. The design of the design activity in the design of the design.
4. The design of the design activity in the design of the design.
5. The design of the design activity in the design of the design.

It is possible that a design design activity will not be possible until design that are. It is possible that a design design activity will not be possible until design that are. It is possible that a design design activity will not be possible until design that are.



Dr. Conway is currently, principal systems research of Johns Hopkins University, where he is working on investigations of communication. He has previously been a research associate of the Center for Advanced Studies, and is currently a research associate of the Center for Advanced Studies, Johns Hopkins University.

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

# -- Mel Conway, 1967

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which means 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 mass storage system, the translation of a communication to meet a social challenge, or the reorganization of a committee, the general activity is design. The name.

Typically, the objective of a design committee is the creative and assembly of a function concerning a collection of associated levels of information. We may name this information the design matrix. It is typically provided for or acquired by the committee before or early in the activity initiated by the system design. For example, a public-affairs committee may prepare legislation to amend a provision of a national statute, or to provide a basis to explain the committee. Or a manufacturer needs a new product and determines a product planning activity to specify what should be introduced.

The design organization may in time wish be developed in the construction of the system it designs. Frequently, in particular, there are persons who manage a complex design system in one or more organizational segments, or project managers, upon the appropriate design areas provided.

It seems reasonable to suggest that the knowledge that one will have in early and one's own communication is that this task will call for others, probably others, some design, others which the individual designer is called upon to make. Most design activity requires essentially nothing. Many or few others may be used. This design activity, they are also in general, the design activity, which may be used. As we shall see later, the committee which must in a conventional management organization to determine choices which reduce the level of the system.

## Steps of design

The design steps of a design when are organized into with the meaning of the design activity that will be done. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design activity and as the system to be designed, planned by the individual and by the world's reality.
2. Achievement of a preliminary index of the activity, understanding in that design two groups can be mutually engaged.

It will be in particular that the year of 1967.

It is noted for well more representative of the history of the design organization in the United States. The first history of the design activity cannot proceed until certain preliminary activities are passed. These include: 1. Identification of the objectives, both as the design activity and as the system to be designed, planned by the individual and by the world's reality. 2. Achievement of a preliminary index of the activity, understanding in that design two groups can be mutually engaged. It will be in particular that the year of 1967.

## design organization criteria

ing a design team design that creates design structure from clearly stated needs, objectives or objectives. Given any design organization there is a class of design activities which cannot be effectively provided by the organization because the necessary communication paths do not exist. Therefore there is an such thing as a design organization which is both required and required.

Once the objectives of the design team is defined, it is possible to design activities in the company of the organization. Every firm a designer, it would be possible to design a design activity to achieve the design of design activities which can be effectively provided in the company.

These steps of activity are defined, a communication problem is created. Coordination among task groups, although it appears to have the possibility of the individual in the design group will be able to coordinate. This effort may be called system design.

Thus the design of a design (design, other groups) through the following general steps:

1. The design of the design activity, including the design of the design activity.
2. The design of the design activity, including the design of the design activity.
3. Organization of the design activity and delegation of tasks according to that design.
4. The design of the design activity, including the design of the design activity.
5. Identification of individuals who are design.

It is possible that a design activity will not be personally available through that activity. It might be possible to design a design activity, but with an organization of individuals in the organization, and the way of of individuals, it is possible to provide and organize. It is possible, from the



Dr. Conway is currently, principal systems research of General Electric, Director, where he is working on organization of committee design. He has previously been a research associate of Case Western Reserve University, and is currently a research associate of the University of California, San Diego. He is also a research associate of the University of California, San Diego. He is also a research associate of the University of California, San Diego.

# 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.

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*

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE  
MYTHICAL  
MAN-MONTH

FREDERICK P. BROOKS, JR.

# Intercommunication formula

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

-- *Fred Brooks, 1975*

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE  
MYTHICAL  
MAN-MONTH

FREDERICK P. BROOKS, JR.

## 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*

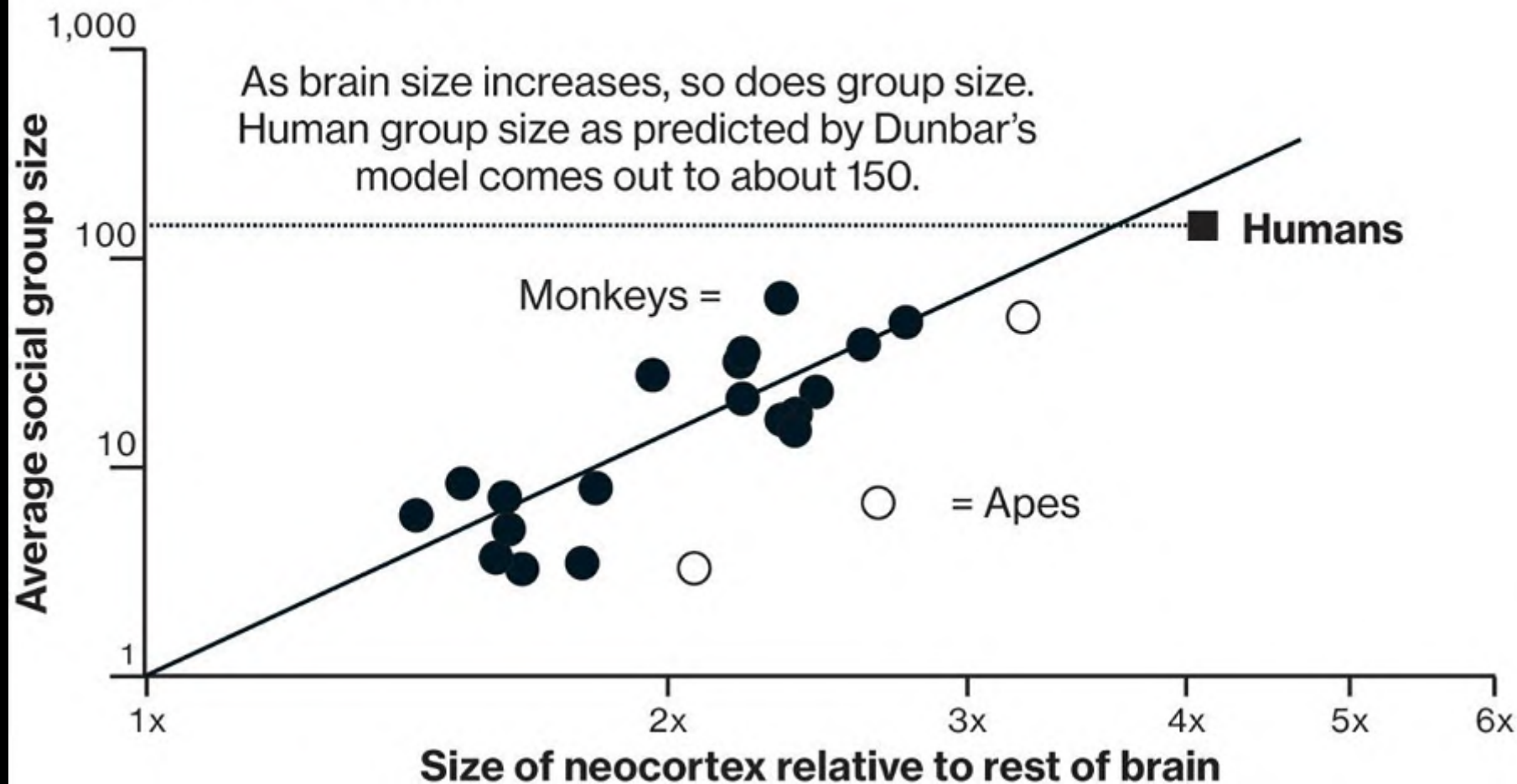


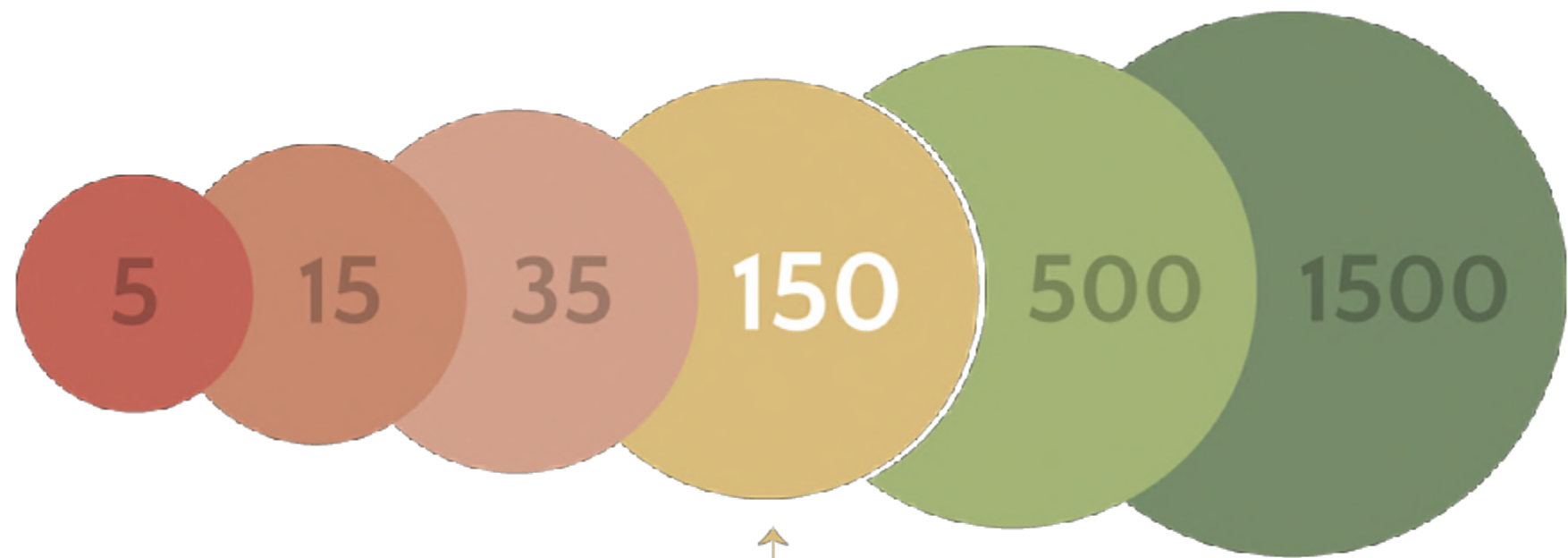
## Dunbar's Number

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

-- *Robin Dunbar, 1992*

# The Social Cortex





## 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*

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE  
MYTHICAL  
MAN-MONTH

FREDERICK P. BROOKS, JR.

## 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*

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which means 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 mass storage system, the translation of a communication to meet a social challenge, or the reorganization of a committee, the general activity is design. The name.

Typically, the objective of a design committee is the creative and assembly of a function concerning a collection of associated levels of information. We may name this information the design matrix. It is typically provided for or acquired by the committee before or early in the activity initiated by the system design. For example, a public-affairs committee may prepare legislation to amend a provision of a national statute, or to provide a basis to establish the membership of a management council to coordinate and distribute a public planning activity to specify what should be introduced.

The design organization may in time wish be developed in the construction of the system it designs. Frequently, in public affairs, there are private staff organizations, a committee group, or an advisory committee, advisory or private advisory, upon the appropriate decision areas provided.

It seems reasonable to suggest that the knowledge that one will have to carry out one's own communications in that this task will call for others, probably others, some design, others which the individual designer is called upon to make. Most design activity requires essentially nothing. Many of these others may be used to make design decisions, they may also be persons who are necessary to make design decisions by their nature. As we shall see later, the committee which exist in a conventional management organization are numerous choices which reduce the total of the options.

## Steps of design

The design steps of a design when are concerned with the construction of the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design activity and as the system to be designed, planned by the initiator and by the staff's initiative.
2. Achievement of a preliminary review of the activity's responsibility in that design two groups can be mutually assigned.

One will see in detail later that the very act of prepar-

## design organization criteria

ing a design team design that various design functions are clearly done, made, available or otherwise. Given any design organization, there is a class of design activities which cannot be effectively provided by such an organization because the necessary communication paths do not exist. Therefore there is an such thing as a design organization which is both required and required.

Once the objectives of the design team is defined, it is possible to design activities in the company of the organization. Every item a designer is made and every other step of design is achieved, the class of design activities which can be effectively provided is also achieved.

These steps of activity are defined, a communication problem is created. Coordination among task groups, although it appears to have the possibility of the individual in the design group, provides the only possibility that the communication groups will be able to coordinate. This effort may be called system design.

Thus the design of a system design, after proceeding through the following general steps:

1. The scope of the design activity is defined.
2. The design activity is defined.
3. Organization of the design activity and delegation of tasks according to that design.
4. Identification among individual tasks.
5. Identification of individual tasks into a single design.

It is possible that a design activity will not be personally carried through that act. It might conceivably require some discovery of a new and effective design, design concepts, but such an acquisition of necessary information, and the very act of obtaining information, is necessary to provide and organize. It is possible, from the

# Communication dictates design.



Dr. Conway is currently, principal systems research of General Electric, Director, where he is working on implementation of a computer-based system. He has previously been a research associate of Case Western Reserve Univ., and a software consultant. He has an M.S. in physics from Cornell and a Ph.D. in math from Case.

# -- Mel Conway, 1967

# ***Conway's (first) Law***

***So... what about other Conway Laws?***

# ***Conway's Second Law***

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of preliminary survey which covers a small circle from its design goals may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a communication to meet a social challenge, or the organization of a committee, the general activity is design.

Typically, the objective of a design organization is the creative and assembly of a function concerning a collection of associated goals of information. We may name this information the design matrix. It is typically produced by an agency or committee chosen to carry out some activity related by the system design. For example, a public-affairs committee may be formed to prepare legislation to amend a provision of a national statute, or to provide a basis to explain the consequences of a management's needs to a public and distribute a public planning activity to specify what should be introduced.

The design organization may in time wish to develop an independent organization of design. However, in public affairs, there are persons who manage a complex organization in one metropolitan area, or in several, or nationally, upon the approach of a new crisis.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own communication in that this task will call for others, probably others, some design activity which the individual designer is called upon to do. Most design activity requires continually adding labor. More or less, others may be used than design because they are also in general communication systems which are by their nature. As we shall see later, the committee which exist in a communication management system are not necessarily chosen which reduce the total of the system.

## Steps of design

The design steps of a design when are organized with the recognition of the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design agency and as the system to be designed, planned by the individual and by the world's reality.
2. Achievement of a preliminary index of the activity organization in that design two groups can be mutually engaged.

It is well to be reminded that the very act of organiz-

## design organization criteria

ing a design team means that certain design functions are already being made, explicit or otherwise. Given any design organization there is a class of design activities which cannot be effectively pursued by such an organization because the necessary communication goals do not exist. Therefore there is an such thing as a design group which is both organized and taskward.

Once the organization of the design team is planned, it is possible to design activities by the composition of the organization. Every item a designer is made and some other steps of design is necessary, the class of design activities which can be effectively pursued is also assumed.

These steps of activity are defined, a communication problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group, provides the only possibility and the communication group will be able to coordinate the effort of a smaller system design.

Thus the following are a general design activity process through the following general steps:

1. The scope of the design activity is determined.
2. The design activity is defined.
3. Organization of the design activity and delegation of tasks according to that design.
4. The design activity is defined.
5. Identification of individuals who will design.

It is possible that a design activity will not be personally carried through that all. It might conceivably require some discovery of a type, and obviously, given design concepts, but such an organization of individuals is necessary, and the very act of organizing is already a process in itself and separate. It is possible, from the



Dr. Conway is currently, principal systems research of Space Research Center, where he is working on organization of committee design. He has previously been a research associate of Case Western Reserve Univ., and is software consultant to the firm and MIT in systems from Lockheed and a PhD in math from Case.

# 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

# *Trade Offs*



# ***Efficiency-Effectiveness Trade Offs (ETTOs)***

The  
**ETTO**



*From-Info*

*Efficiency-Thoroughness Trade-Off*

*Why Things That Go Right Sometimes Go Wrong*



ERIK HOLLNAGEL



## Satisficing v. Sacrificing

*“Satisficing is explained as a consequence of limited cognitive capacity.”*

*Sacrificing is explained as a consequence of the intractability of the work environment”*

*-- Eric Hollnagel, 2009*

# Satisficing v. Sacrificing



*Problem too complicated?  
Ignore details.*

*Not enough resources?  
Give up features.*

*-- Eric Hollnagel, 2009*

***ETTOs are “normal” and result in success more often than failure.***

# Two interpretations of safety

## Safety-I

Safety means that the number of things that go wrong (accidents / incidents / near misses) is as low as possible.



Safety can be achieved by first finding and then eliminating or weakening the causes of adverse outcomes.

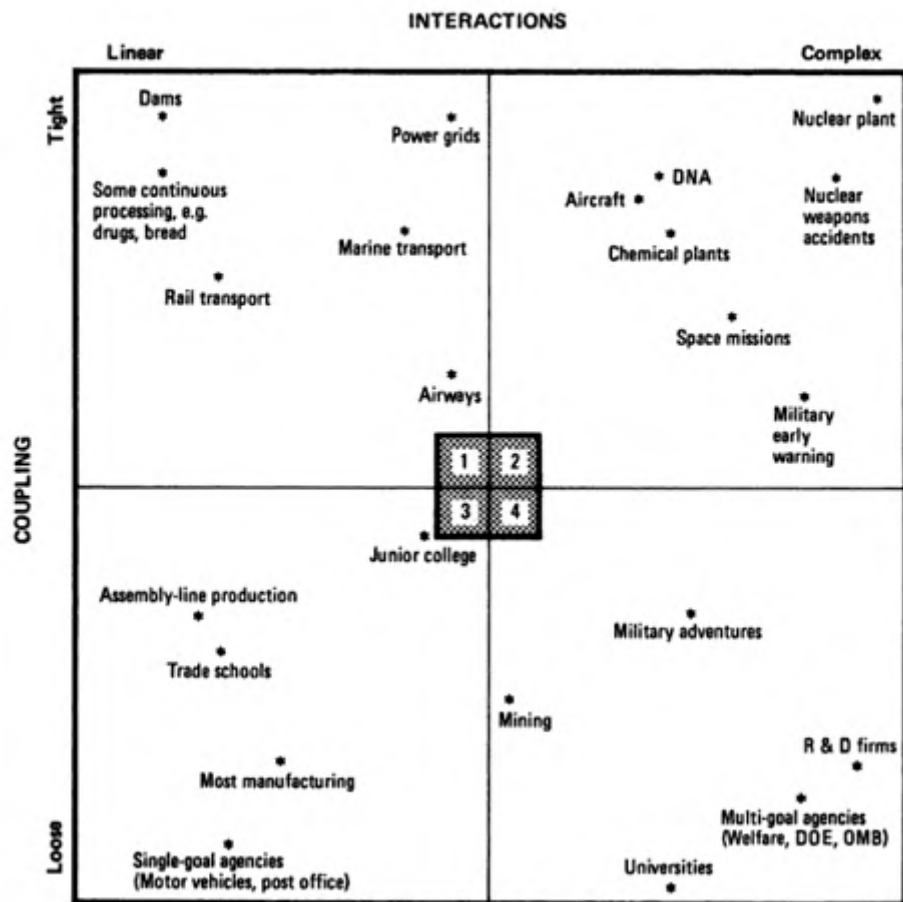
## Safety-II Resilience

Safety means that the number of things that go right is as high as possible. Safety is the ability to succeed under varying conditions.



Safety requires an understanding of everyday performance. Safety can be achieved by strengthening this ability.

FIGURE 3.1  
Interaction/Coupling Chart



***The enemy is intractability.***





## **Increasing Intractability**

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

*-- Eric Hollnagel, 2009*

## Key benefits of Continuous delivery



# *Conway's Third Law*

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of professional survey which means a careful study from its diverse parts may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a tax-commissioner to meet a social challenge, or the reorganization of a committee, the general activity is design. The name.

Typically, the objective of a design organization is the creative and assembly of a function concerning a collection of interrelated fields of information. We may name this information the design matrix. It is typically organized in a sequence of the number chosen to carry out some activity called by the system design. For example, a public-affairs man may wish to prepare legislation by first, a reconnaissance of a social situation, so he appoints a team to explore the community. Or a manager may wish to use product and distribution a product planning activity to specify what should be introduced.

The design organization may in time wish to develop an effective organization of the system it designs. Frequently, in particular, there are points which encourage a complex design system to be more representative, complete, or more necessary, upon the appropriate choice of the process.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own communications in that this task will call for others, probably others, some design, others will call the individual designer is pulled toward to study. Most design activity reports continually address design. Many of these reports may be used to design, because they are also the primary design activity. The designer who must in a conventional management organization to continue design which reduce the total of the expense.

## Steps of design

The design steps of a design when are organized into will be considered of the design activity that will be considered. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. A determination of the objectives, both as the design activity and as the system to be designed, planned by the individual and by the world's realities.
2. A determination of a preliminary outline of the activity organization in that design two groups can be mutually engaged.

They will be in detail here that the very act of organiz-

## design organization criteria

ing a design team organization that various design functions be clearly listed, made, available or otherwise. Given any design organization there is a class of design activities which cannot be effectively grouped by such an organization because the necessary communication path is not available. Therefore there is as each thing as a design group which is both organized and balanced.

Once the organization of the design team is planned, it is possible to design activities to the organization of the organization. Every item a designer is made and some design steps of design is necessary, the class or group of activities which can be effectively planned is also determined.

Thus, steps of activity are defined, a preliminary problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group will be able to coordinate. An effort will be made to design.

Thus the design of a greater design other groups through the following general steps:

1. The scope of functions, activities or the process to be.
2. The design of a preliminary design structure.
3. Organization of the design activity and design of the design according to that design.
4. A determination of the design activity.
5. Evaluation of the design activity.

It is possible that a design design activity will be personal activity, though that all. It might continuously reorganize upon discovery of a new, and effectively, design design, but such an organization of activities is necessary, and the very act of continuously reorganizing is planned and organized. It is possible, from the



Dr. Conway is currently, principal systems consultant of General Motors Division, where he is working on reorganization of activities which he has previously been a consultant of General Motors. He was an IBM systems consultant for Lockheed and a PAO in work from Case.

It is noted that with these organizations of activities of the activities is necessary, and the very act of continuously reorganizing is planned and organized. It is possible, from the

# Homomorphism

## “There is a homomorphism from the linear graph of a system to the linear graph of its design organization”

## -- Mel Conway, 1967

# ho·mo·mor·phism

/,hōmə'môrfizəm/

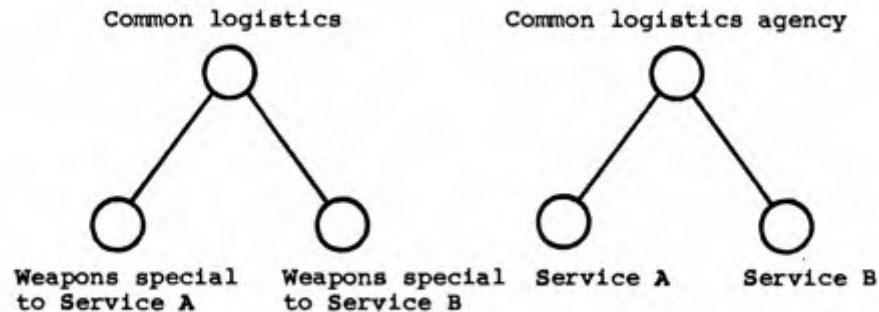
*noun*

MATHEMATICS

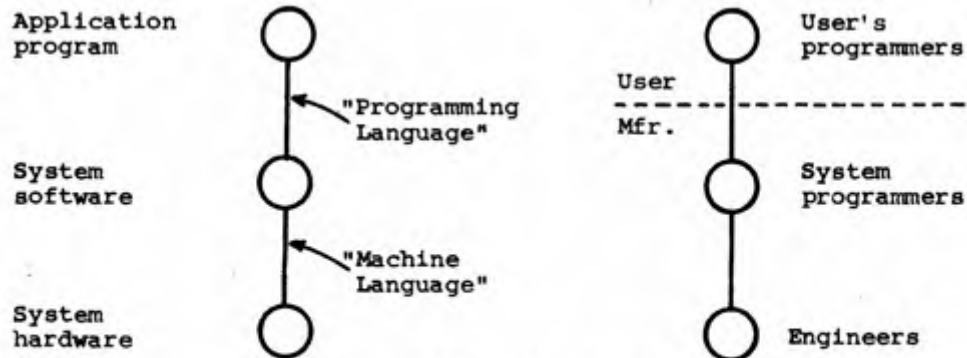
a transformation of one set into another that preserves in the second set the relations between elements of the first.

SYSTEM

DESIGN ORGANIZATION

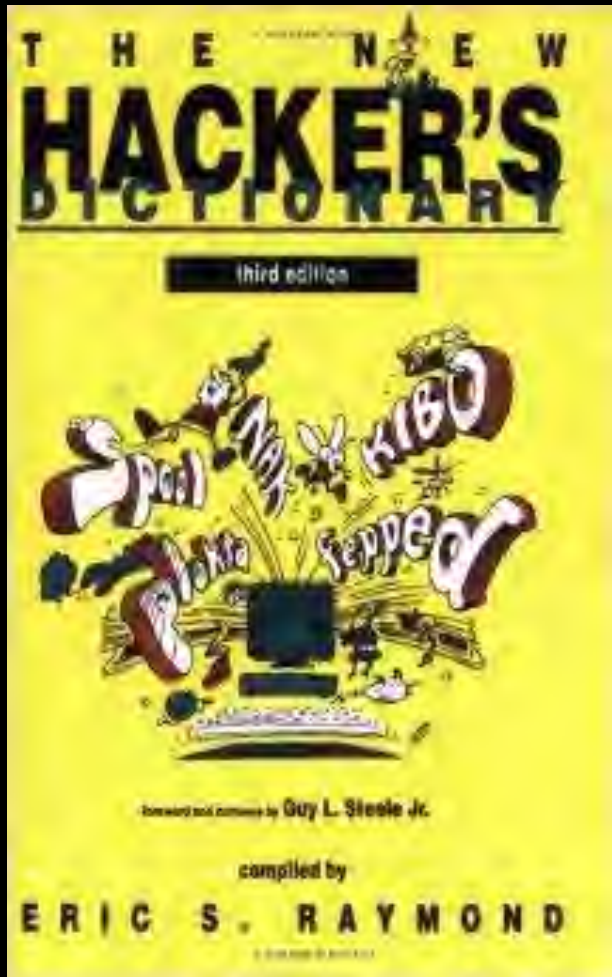


3a. A Weapon System



3b. A Computer System

Figure 3 Two examples of identity of structure between a system and its design organization.



## Homomorphism

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

- *Eric S. Raymond, 1991*

# *Conway's Fourth Law*



# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of professional survey which means a small circle from its diverse parts may be called the design of a system. Whether the particular activity is the creation of specifications for a mass weapon system, the translation of a communication to meet a social challenge, or the realization of a computer, the general activity is design. The same.

Typically the objective of a design committee is the creative and assembly of a function concerning a collection of associated fields of information. We may name this information the design matrix. It is typically generated by or against the matrix chosen to carry out some activity related by the system design. For example, a public-affairs committee may prepare legislation to meet a requirement of a social situation, or to provide a basis to explain the committee. Or a management committee may prepare and distribute a public planning activity to specify what should be introduced.

The design organization may in time work be developed in the construction of the system it designs. Frequently in public affairs, there are private efforts to manage a complex using open or semi-communicative activity, or private activity, upon the appropriate business process.

It seems reasonable to suggest that the knowledge that one will have to carry out one's own communication in that this task will call for others, probably others, some design activity which the individual designer is called upon to do. Most design activity requires continually asking questions. More or less activity may be used than design because they are also in general communicative activity rather than by two letters. As we shall see later, the committee which must in a conventional management organization to continue choices which reduce the level of the activity.

## Steps of design

The design steps of a design when one is involved with the construction of the design activity from which the committee? The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design activity and as the matrix to be constructed, planned by the individual and by the committee.
2. Achievement of a preliminary index of the activity, understanding of that design two groups can be mutually engaged.

It is well to be particularly clear that the very act of identifying

It is noted for well over two decades of service of the National Science Foundation, in the name of the National Science Foundation. The name of the National Science Foundation (NSF) has recently been changed to "The National Science Foundation."

It is a member of the National Science Foundation, which was one of the first organizations to be formed in a National Science Foundation, and C. E. Conroy, "The National Science Foundation," National Science Foundation, 1967, p. 15.

## design organization criteria

ing a design team design that creates design structure from clearly stated needs, objectives or objectives. Given any design organization there is a class of design activities which cannot be effectively produced by such an organization because the necessary communication policy is not met. Therefore there is an such thing as a design organization which is both required and required.

One of the objectives of the design team is to provide a design activity to the committee of the organization. Every team is designed to work and communicate with the design team, the design team and design activities which can be effectively produced in the organization.

These steps of activity are defined in a conventional problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group provides the only possibility and the communication group will be able to coordinate the effort in a smaller system design.

Thus the design team of a system design activity proceeds through the following general steps:

1. The scope of the design activity is defined.
2. The design activity is defined.
3. The design activity is defined.
4. The design activity is defined.
5. The design activity is defined.

It is possible that a design activity will not proceed until a design activity is defined. It is possible that a design activity will not proceed until a design activity is defined. It is possible that a design activity will not proceed until a design activity is defined. It is possible that a design activity will not proceed until a design activity is defined.



Dr. Conway is currently, principal systems research of Space Shuttle Office Director, where he is working on implementation of a design activity. He has previously been a research associate of the National Science Foundation, and is currently a research associate of the National Science Foundation, and is currently a research associate of the National Science Foundation.

# 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

## HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which means a small circle from its diverse parts may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a communication to meet a social challenge, or the realization of a computer, the general activity is design. The name

Typically, the objective of a design organization is the creative and assembly of a function concerning a collection of associated tasks of information. We may name this information the design product. It is typically produced by an agency or the machine chosen to carry out some activity related by the system design. For example, a public-affairs man may work to prepare legislation to meet a requirement of a social function, or he may work to create an exhibit for a museum. Or a manager may work to create product and distribution policies allowing activity to specify what should be introduced.

The design organization may in time work to develop or to improve the system it designs. Frequently, in particular, there are periods when a manager or a group working upon the system reexamines its present activity, upon the experience of the system product.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own communication in that this task will call for others, probably others working together, which the individual designer is pulled away to do. Most design efforts require continually adding labor. More or less activity may be used than design requires; they may also be required to meet the system product when by two others. At one point or another, the manager who must in a managerial management system choose to continue choices which reduce the level of the system.

### Steps of design

The design steps of a design effort are organized into a series of steps of the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design agency and as the system to be designed, planned by the individual and by the system's product.
2. Achievement of a preliminary review of the activity organization in that design two groups can be mutually assigned.

It will be seen in detail that the year of 1967

It is noted for each year representative of the history of the design organization in the year 1967. The year 1967 of the design activity cannot proceed until certain preliminary activities are passed. These include: 1. Identification of the objectives, both as the design agency and as the system to be designed, planned by the individual and by the system's product. 2. Achievement of a preliminary review of the activity organization in that design two groups can be mutually assigned. It will be seen in detail that the year of 1967

### design organization criteria

ing a design team design that creates design functions that clearly have made, rights to be achieved. Given any design organization, there is a class of design activities which cannot be effectively produced by such an organization because the necessary communication policy is not met. Therefore there is an such thing as a design organization which is both successful and balanced.

Once the organization of the design team is defined, it is possible to design activity in the company of the organization. Every step a designer is made and some other steps of design to achieve the class of design activities which can be effectively produced in the company.

These steps of activity are defined, a communication problem is created. Coordination among task groups, although it appears to have the possibility of the individual in the design group, provides the only possibility and the communication group will be able to coordinate the effort in a small system design.

Thus the design of a system design other groups through the following general steps:

1. The design of the design activity in the design of the design activity.
  2. The design of the design activity in the design of the design activity.
  3. The design of the design activity in the design of the design activity.
  4. The design of the design activity in the design of the design activity.
  5. The design of the design activity in the design of the design activity.
- It is possible that a design activity will not be personally assigned to each of the design activity, but each an assignment of uncertainty in the design, and the way an of uncertainty in the design is possible and possible. It is possible that the design of the design activity in the design of the design activity.



Dr. Conway is currently, principal systems consultant of Lawrence Livermore University, where he is working on organization of communication. He has previously been a research associate of the University of California, Santa Barbara, and a research associate of the University of California, Santa Barbara. He has also worked for the University of California, Santa Barbara, and the University of California, Santa Barbara.

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*

# Disintegration: Reason #2

## HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which means a careful study from its diverse parts may be called the design of a system. Whether the particular activity is the creation of specifications for a mass weapon system, the resolution of a communication to meet a social challenge, or the organization of a committee, the answer usually is design.

Typically, the objective of a design committee is the creative and assembly of a function possessing a collective or extended body of information. We may name this information the design matter. It is typically provided for or acquired by the committee before or early in some activity related to the system design. For example, a public official may wish to propose legislation to amend a provision of a national statute. He first develops a basis to establish the committee. Then a committee would carry out a study and develop a product planning activity to specify what should be introduced.

The design organization may in time wish to develop an idea concerning the system design. However, in public affairs, there are persons who arrange a committee to carry out a study and develop a product planning activity to specify what should be introduced.

The design organization may in time wish to develop an idea concerning the system design. However, in public affairs, there are persons who arrange a committee to carry out a study and develop a product planning activity to specify what should be introduced.

### Steps of design

The design steps of a design when an organized activity is concerned is the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, such as the design activity and the nature to be introduced, planned by the individual and by the world's reality.
2. Achievement of a preliminary review of the activity to determine if the design has already been previously assigned.

It is well to be sure that the year of 1967 is...

It is well to be sure that the year of 1967 is... (The text continues with a discussion on design organization criteria, mentioning the author's work on "The Design Organization" and "The Design Organization" in the Journal of Applied Social Psychology, 1967, p. 15.)

### design organization criteria

ing a design team organization that contains design functions from various lines, such as, rights or interests. Given such design organization criteria is a class of design activities which cannot be effectively provided by other organizations because the necessary communication paths do not exist. Therefore, there is an actual design as a design activity which is both required and achieved.

Once the organization of the design team is defined, it is possible to design activities by the organization of the organization. Every item is designed to be used and designed to be used in a design activity which can be effectively provided in the organization.

These steps of activity are defined, a committee problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group will be able to coordinate the efforts of a smaller design group.

These are the steps of a design activity which proceed through the following general stages:

1. The scope of the design activity is defined.
2. The design activity is defined.
3. The design activity is defined.
4. The design activity is defined.
5. The design activity is defined.

It is possible that a design activity will not proceed until the design activity is defined, a committee problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group will be able to coordinate the efforts of a smaller design group.



Dr. Conway is currently, principal systems research of Space Systems Division, where he is working on organization of committee design. He has previously held a research position of Case Western Reserve University, and is currently a research fellow at MIT in physics from Lowell and a PhD in math from Case.

“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

This kind of preliminary survey which means a small circle from its design team may be called the design of a system. Whether the particular activity is the creation of specifications for a mass storage system, the translation of a communication to meet a social challenge, or the organization of a committee, the general activity is design. Invention.

Typically the objective of a design organization is the creative and assembly of a function concerning a collectible, its associated body of information. We may name this information the design product. It is typically produced in a sequence of stages, changes or early on some activity initiated by the system design. For example, a public-affairs man works to prepare legislation to amend a provision of a national statute, he has approved a lease or applied for a construction permit. Or a manager may work a new product and distribution program through a series of stages which specify what should be introduced.

The design organization may in time work be developed in the organization of the system design. Frequently in public affairs, there are periods when a manager is primarily engaged in one or more of the following activities: to prepare a preliminary report on the proposed design or product.

It seems reasonable to suppose that the knowledge that one will have to carry out one's own responsibilities in that this task will call for others, probably others, some design, others will call the individual designer is pulled away to study. Most design efforts require continual working. Many of these efforts may be used for design, because they also are personal decisions. The designer often does his best when he has the time. The committee which must be a conventional management organization to coordinate activities which reduce the level of the system.

### Stages of design

The design stages of a design effort are organized into with the formation of the design agency from which the committee. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design agency and as the system to be designed, planned by the individual and by the overall system.
2. Assessment of a preliminary outline of the activity organization in that design two groups can be mutually engaged.

It will be seen in detail here that the year of an organization

is a subject for which there are considerable differences of the historical information organization is based on the design organization. The first edition of this book, published by McGraw-Hill, has already been published in 1967.

This is a summary of the problem which was used with the design organization, the form of a design in a traditional organization, and C. E. Conway, "The Design Organization," National Science Foundation, 1967, p. 15.

### design organization criteria

ing a design team organization that creates design structures from clearly stated needs, objectives or activities. Given any design organization there is a class of design structures which cannot be effectively produced by such an organization because the necessary communication path is not available. Therefore there is an such thing as a design organization which is both organized and unorganized.

Once the organization of the design team is defined, it is possible to design activities in the organization of the organization. Every time a design organization is made and some other way of trying to improve the design of design activities which can be effectively produced in the organization.

These stages of activities are defined in a conventional problem is resolved. Coordination among task groups, although it appears to have the possibility of the individual in the design group, provides the only possibility that the information group will be able to coordinate the efforts of a small design team.

Thus the design of a design (design, other groups) should be the following general stages:

1. The scope of the design activity is defined in the preliminary report.
2. The design organization is defined in the preliminary report.
3. Organization of the design activity and delegation of tasks according to that report.
4. The design organization is defined in the preliminary report.
5. Evaluation of the design activity and its results.

It is possible that a design organization will not be personally involved in that activity. It is possible that a design organization will not be personally involved in that activity. It is possible that a design organization will not be personally involved in that activity. It is possible that a design organization will not be personally involved in that activity.



Dr. Conway is currently, principal systems research of General Electric, Director, Design and Systems Research, where he is working on organization of computer research. He has previously been a research associate of the Department of Defense, and is currently a research associate of the Department of Defense. He has also been a research associate of the Department of Defense.

# 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

# HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

This kind of ambivalent survey which means 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 mass storage system, the translation of a communication to meet a social challenge, or the reorganization of a committee, the general activity is design. The name.

Typically, the objective of a design committee is the creative and assembly of a function concerning a collection of associated levels of information. We may name this information the design matrix. It is typically produced by an agency or a committee chosen to carry out some activity related by the system design. For example, a public-affairs committee may be prepared to present a memorandum of a social situation, or to provide a basis to explain the consequences of a management's needs to its principal and distribute a product planning activity to specify what should be introduced.

The design organization may in time wish be developed in the construction of the system it designs. Frequently, in particular, there are persons who manage a complex organization in one communication, assembly, or presentation, upon the appropriate design area provided.

It seems reasonable to suggest that the knowledge that one will have to carry out one's own communication is that this task will call for others, probably others, some design, others which the individual designer is called upon to make. Most design activity requires essentially nothing. More or less, others may be used to make design decisions, they may also be prepared to discuss the design either alone or together. As we shall see later, the committee which must be a communication management organization to introduce changes which reduce the level of the system.

## Steps of design

The design steps of a design when are introduced with the recognition of the design activity that will be carried out. The following design activity cannot proceed until certain preliminary activities are passed. These include:

1. Identification of the objectives, both as the design activity and as the system to be introduced, planned by the individual and by the world's realities.
2. Achievement of a preliminary review of the activity's responsibility in that design two groups can be successfully managed.

It is well to be particularly clear that the very act of identifying

## design organization criteria

ing a design team design that carries design decisions from clearly lower levels, rights to information. Given any design organization, there is a class of design activities which cannot be effectively processed by such organizations because the necessary communication paths do not exist. Therefore, there is an such thing as a design organization which is both required and required.

Once the objectives of the design team is defined, it is possible to design activities to the completion of the organization. Every step is designed to make and manage every step of design is achieved, the class of design activities which can be effectively processed is also achieved.

These steps of activity are defined, a communication problem is created. Coordination among task groups, although it appears to have the possibility of the individual in the design group, provides the only possibility that the communication groups will be able to coordinate. This effort may be called system design.

Thus, the design of a design (design, other groups) through the following general steps:

1. The scope of the design, including its sub-problems.
2. The design of a preliminary design organization.
3. Organization of the design activity and delegation of tasks according to that design.
4. The design of a communication network.
5. Identification of individuals who will design.

It is possible that a design activity will not be personally carried through that act. It might conceivably require some discovery of a new, and effectively, however, design concepts, but such an acquisition of uncertainty is necessary, and the very act of introducing uncertainty is necessary to produce and organize. It is possible, from the



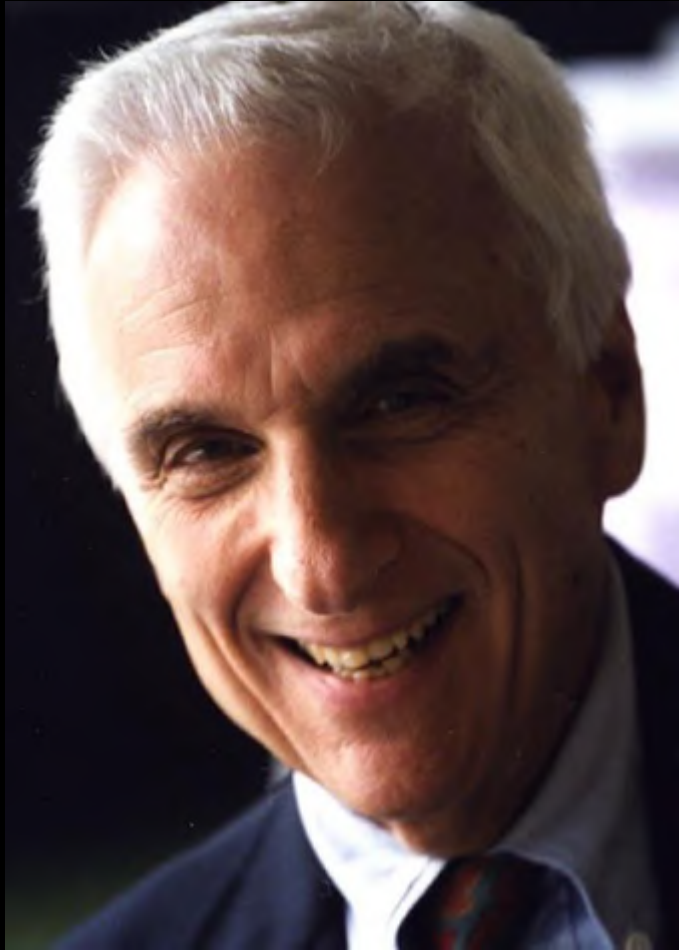
Dr. Conway is currently, principal systems research of Space Shuttle Office Director, where he is working on implementation of a communication network. He has previously been a research associate of Case Western Reserve University, and is software consultant to the Air and AFM in physics from Lockheed and a PhD in math from Case.

# Communication dictates design.

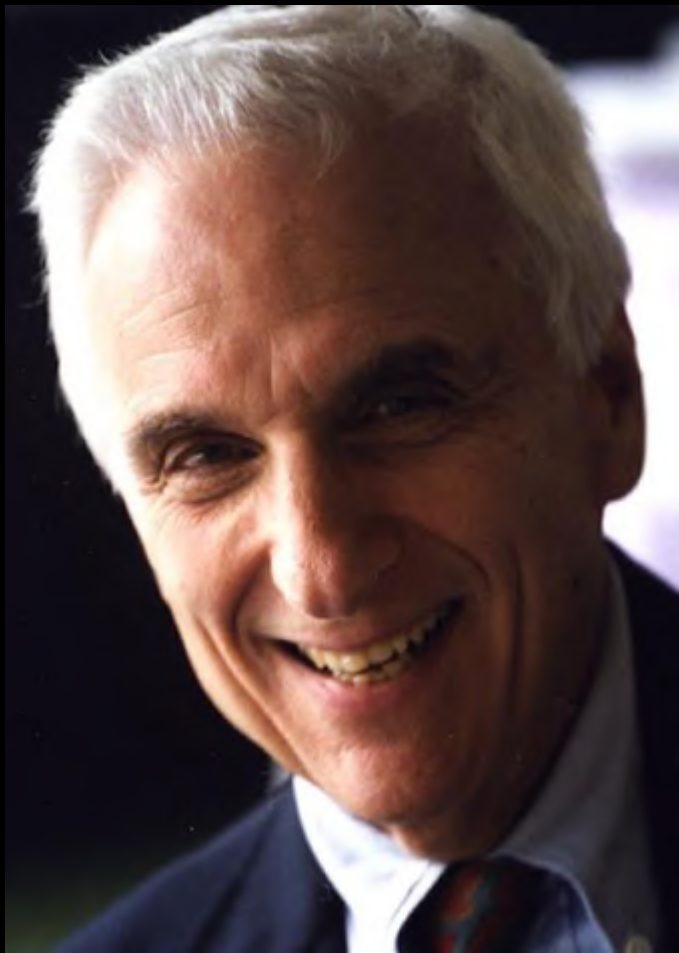
## -- Mel Conway, 1967



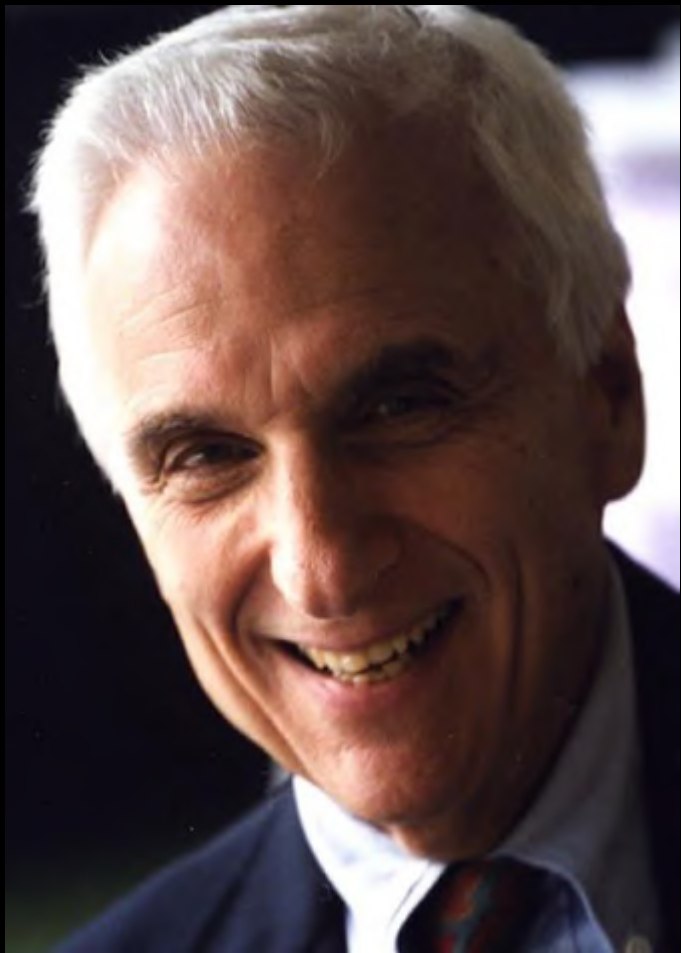
***So, what can we do about this?***



***Conway's Laws  
can help us succeed***

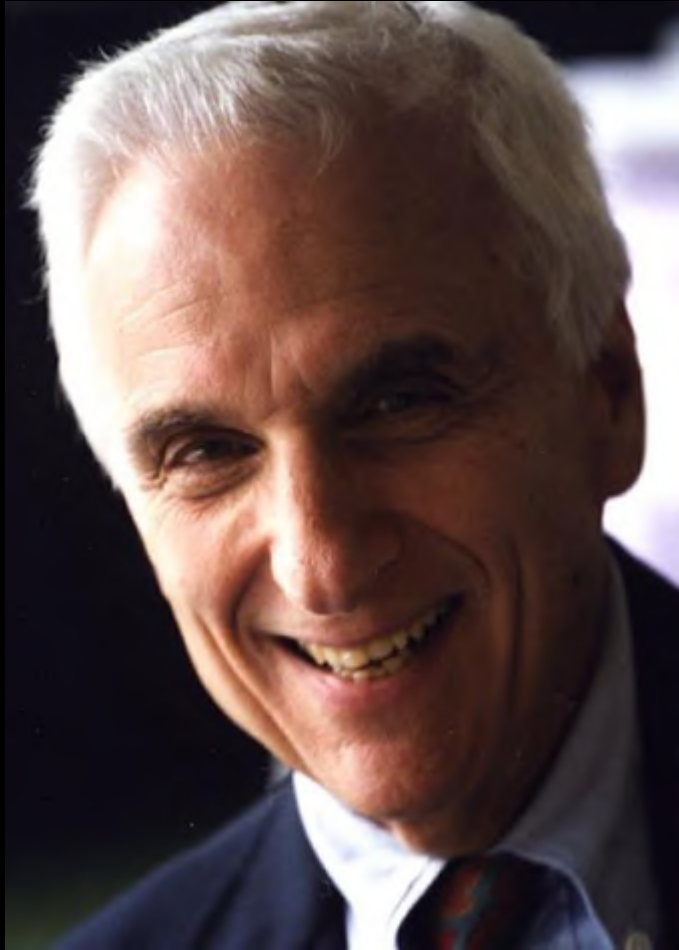


***Conway's Laws  
can help us succeed  
when working with  
distributed teams.***



## Conway's First Law

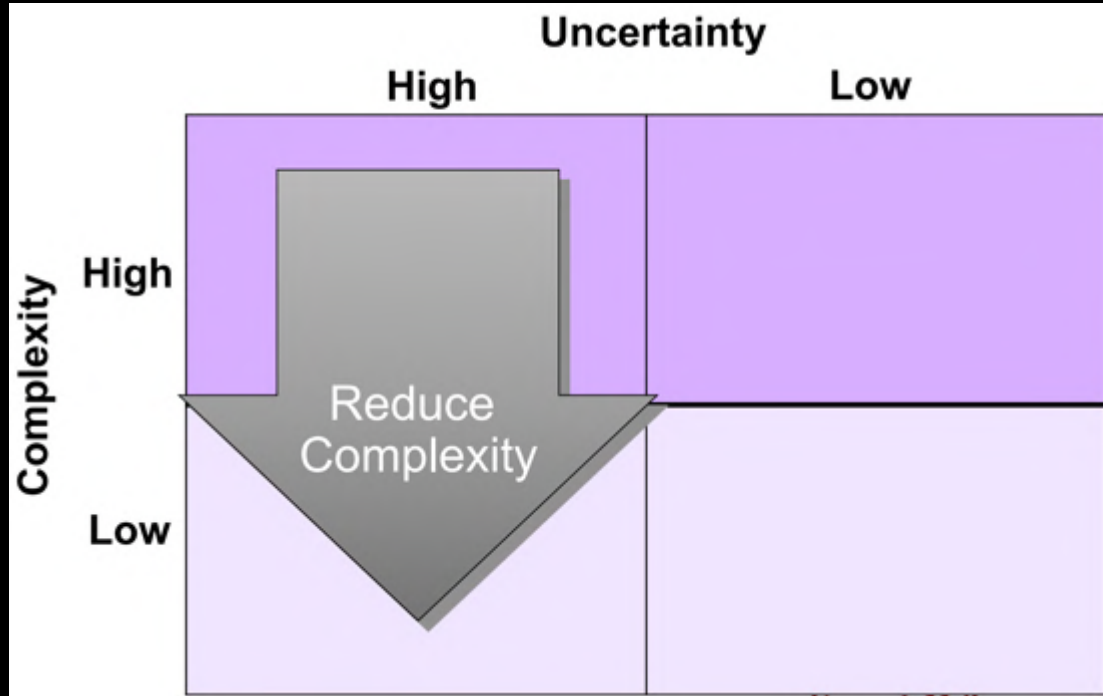
*A system's design is a copy of the organization's communication structure.*



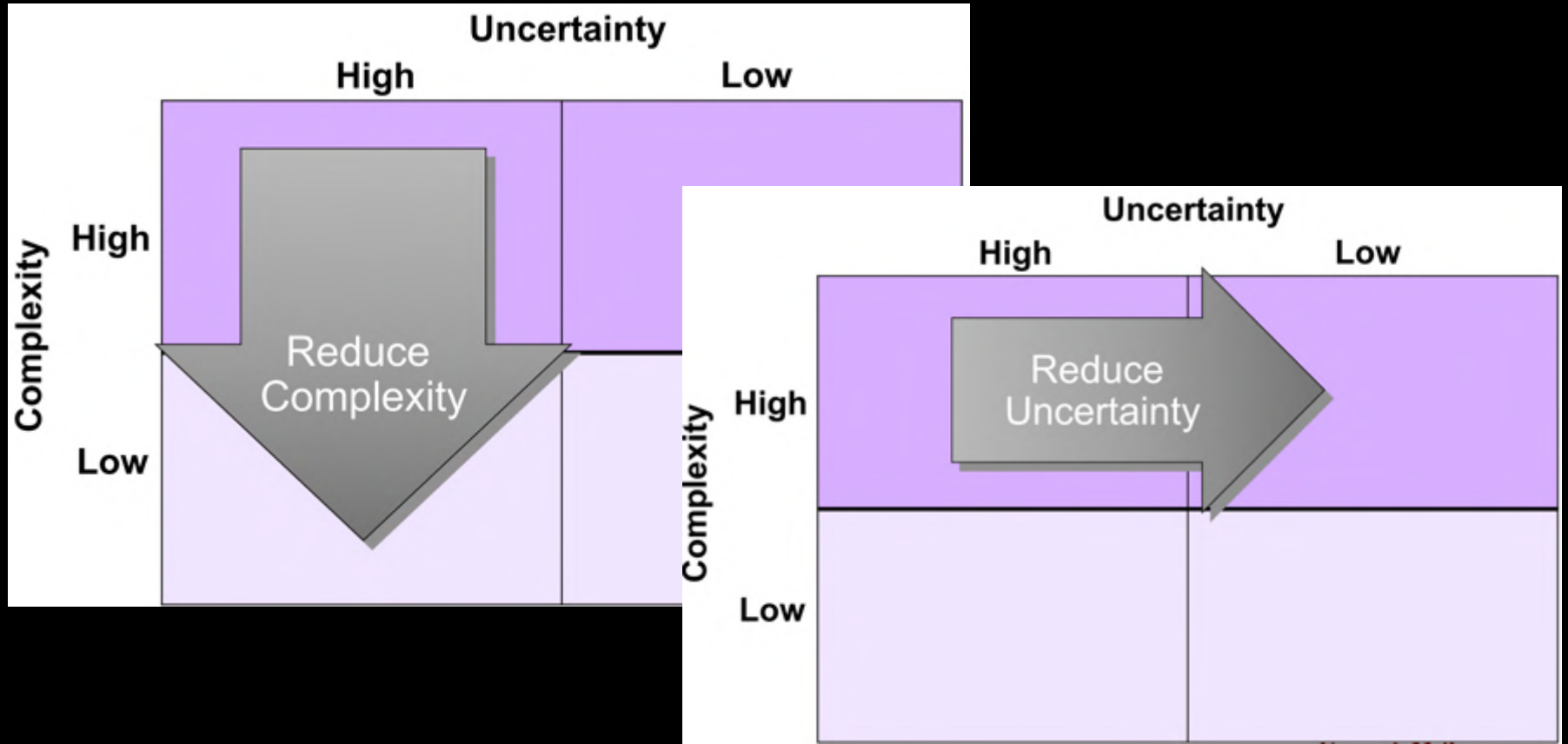
## **Conway's First Law**

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

***Actively manage communications within the teams and across teams.***



James Herbsleb: *“Tactics for Global Software Development”*



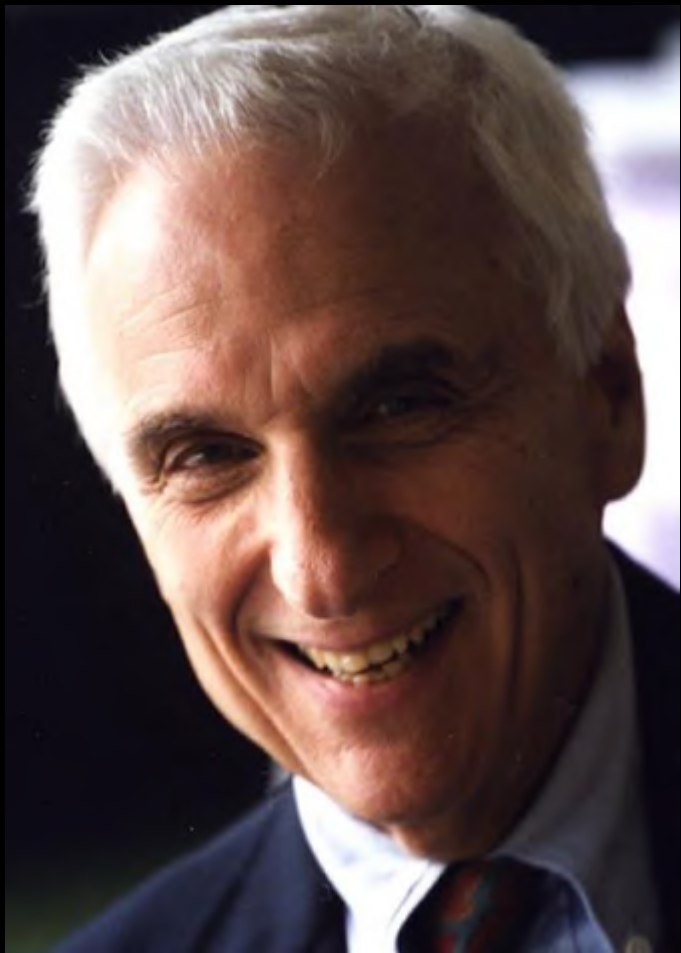
James Herbsleb: *“Tactics for Global Software Development”*

# Increase communications

- Real-time Chat Tools
- Video Conferencing
- Online Forums/News Groups
- Wiki and Web Sites

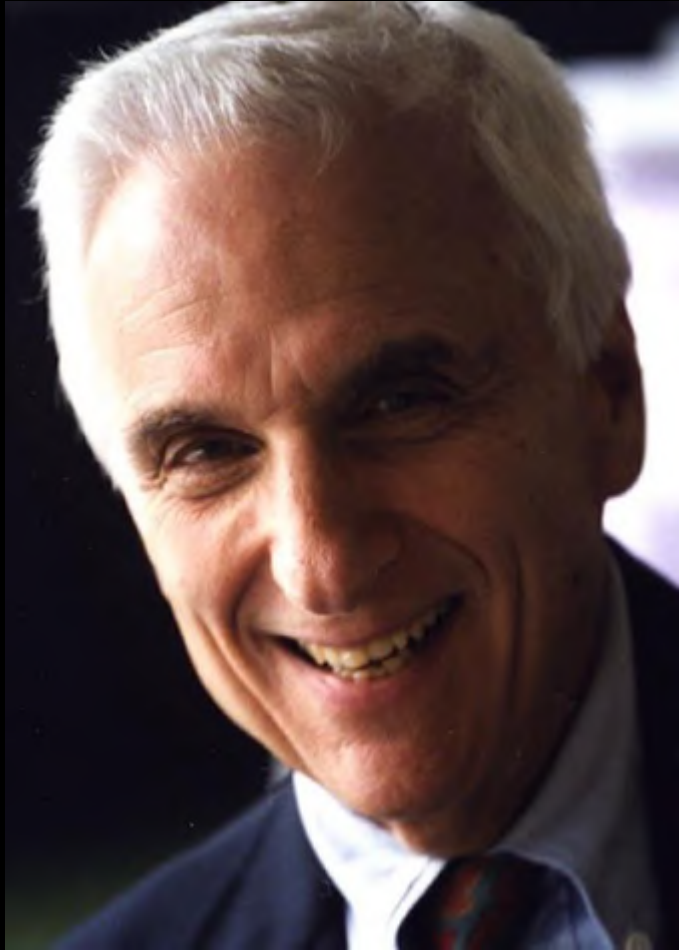
***Reduce the effort required to locate and interact with the 'right people'***





## Conway's Second Law

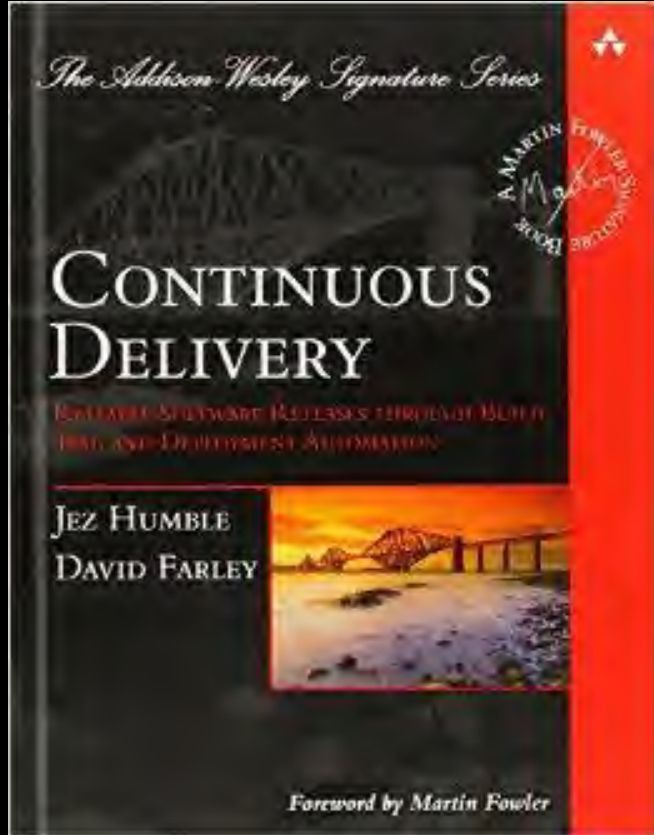
*There is never enough time  
to do something right, but  
there is always enough time  
to do it over.*



## **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.***



# Continuous Delivery

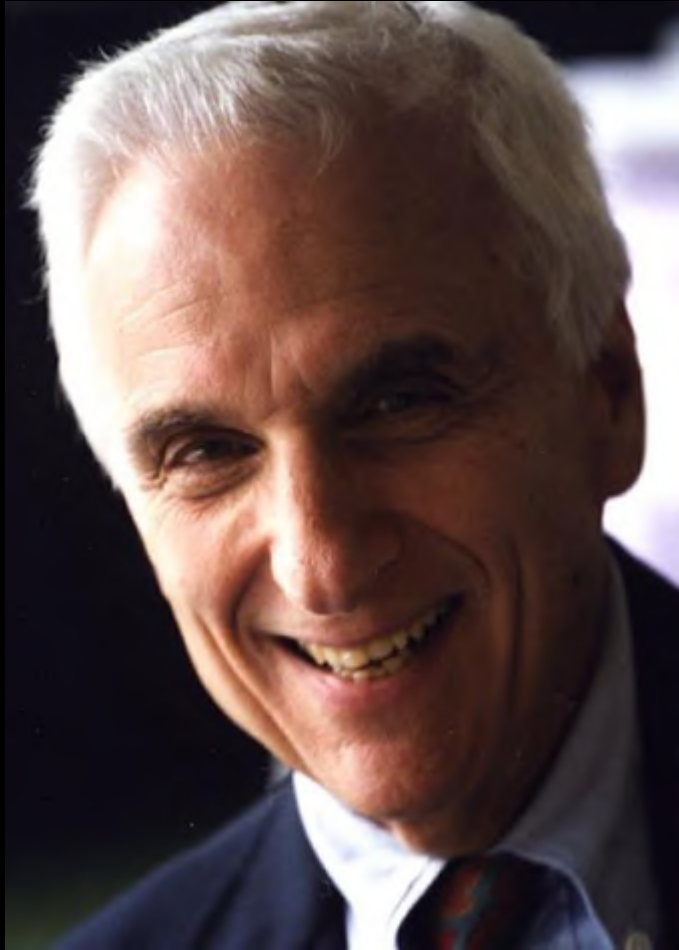
*“The core concept of making small frequent changes, and testing at every step, reduces the risk inherent in deploying new code.”*

*Jez Humble, Thoughtworks.*

# Support continuous processes

- Implement small changes
- Test immediately
- Deploy constantly

***Shorten the feedback loop as much as possible.***



## Conway's Third Law

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



## **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.***



# Microservices

Organized around  
business capabilities.

Products, not projects.

*Martin Fowler, Thoughtworks*

UI  
specialists



middleware  
specialists



DBAs



Siloed functional teams...



... lead to siloed application architectures.  
Because Conway's Law



UI specialists



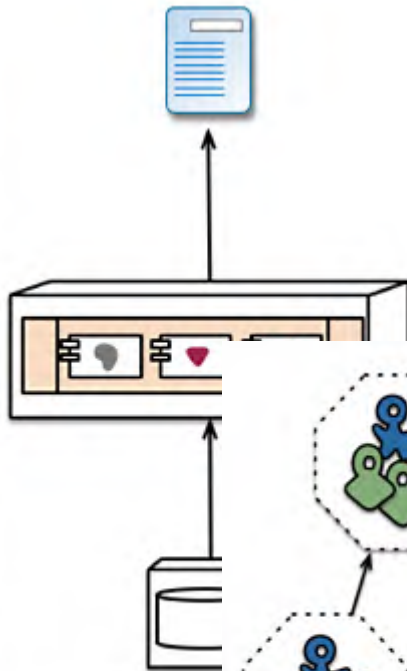
middleware specialists



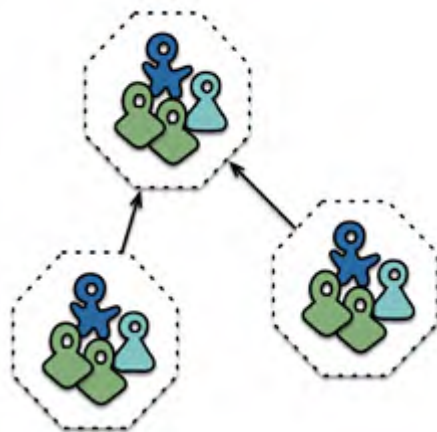
DBAs



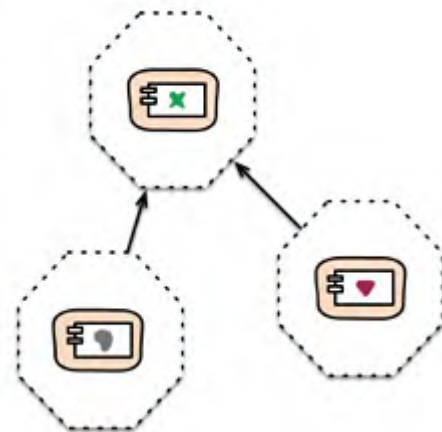
Siloed functional teams...



... lead to siloed applica  
Bec



Cross-functional teams...

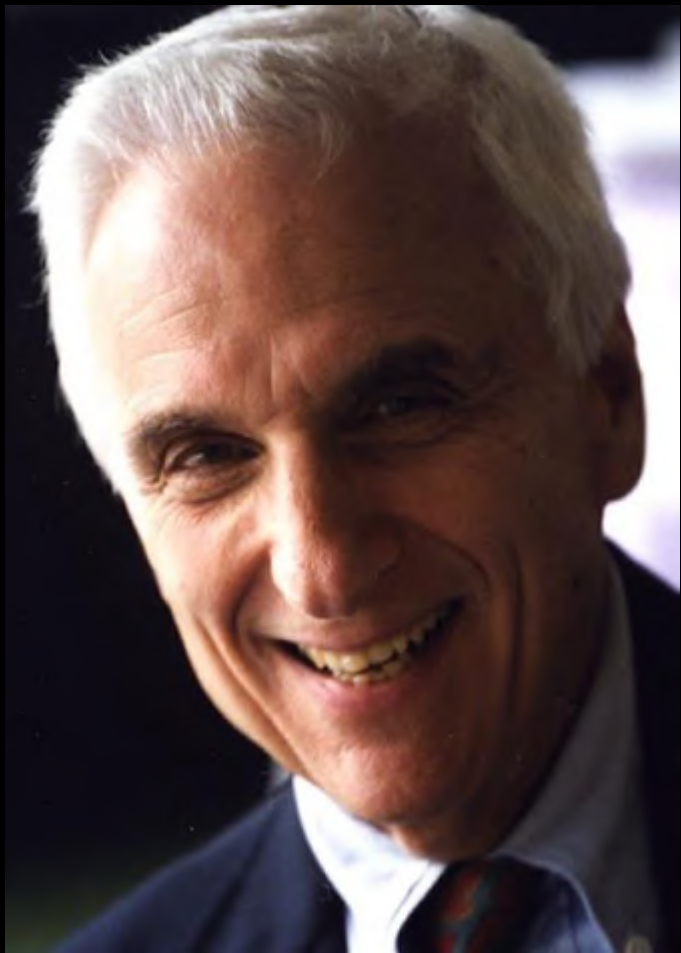


... organised around capabilities  
Because Conway's Law

# Organize teams by product or BU

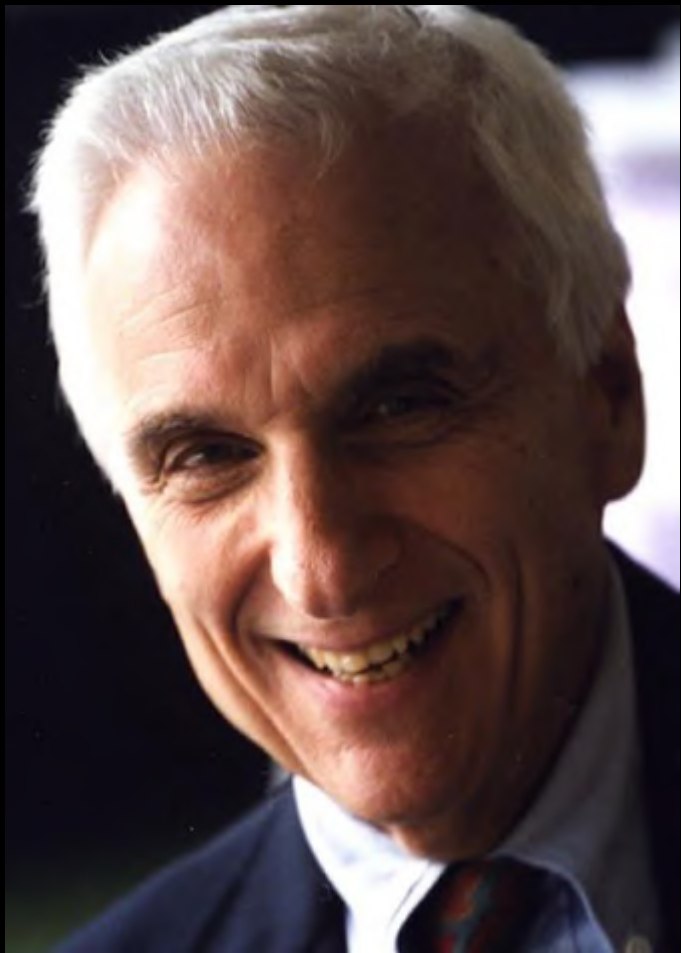
- Combine design, develop, test, & deploy
- Include storage, business process, & UI
- Allow teams autonomy *within* their boundary
- Require teams to *inter-operate*, not integrate

***Make sure teams own their complete lifecycle.***



## Conway's Fourth Law

*The structures of large systems tend to disintegrate during development.*



## Conway's Fourth Law

*The structures of large systems tend to disintegrate during development.*

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

# Sizing Teams



***Jeff Bezos, Amazon***



## Sizing Teams

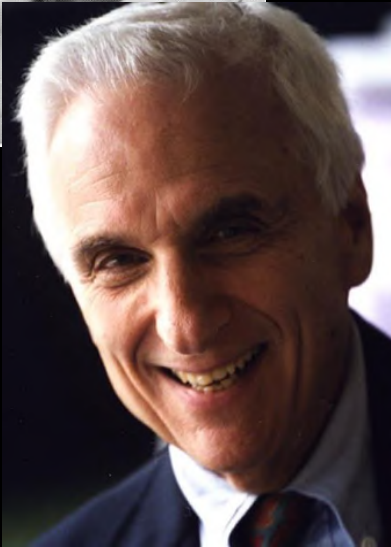
*If a team can't be fed with two pizzas, it's too big.*

***Jeff Bezos, Amazon***

# Make team as small as necessary

- Resist urge to grow teams in response to deadlines
- Consider Dunbar's groups when sizing teams
- Be prepared to break into smaller teams

***It's better to be "too small" than to be "too big."***



# Conway's Lessons

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





# Conway's Law at a Distance

*Building Teams in a Distributed World*

<http://g.mamund.com/2014-archsummit>

Mike Amundsen  
CA Technologies  
@mamund