# My 45+ Years at UW
## Emeritus Lecture

June 2, 2017

Richard E. Ladner
University of Washington

# Themes

- Before UW
- UW
- Beyond UW

# Before UW

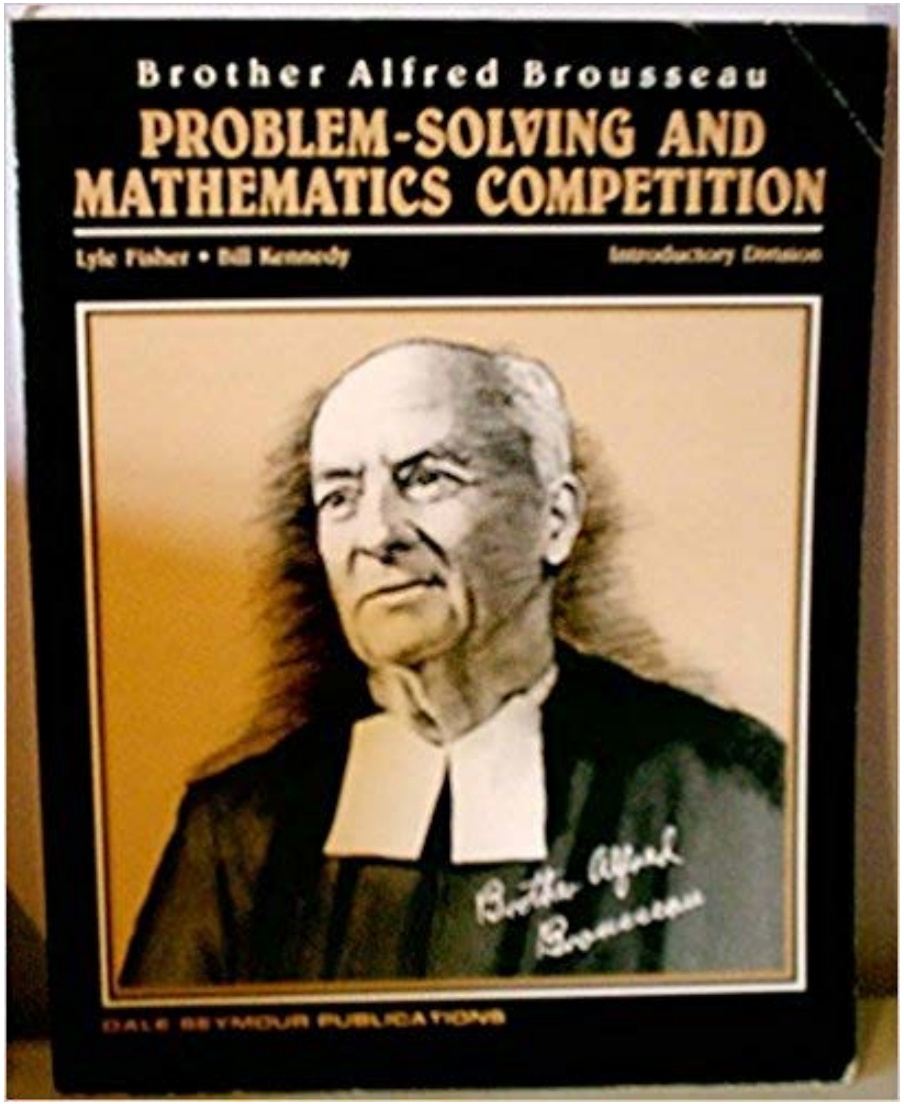
Ladner Family
1946

2013

# St. Mary's College of California

## 1961-1965

# Brother Alfred



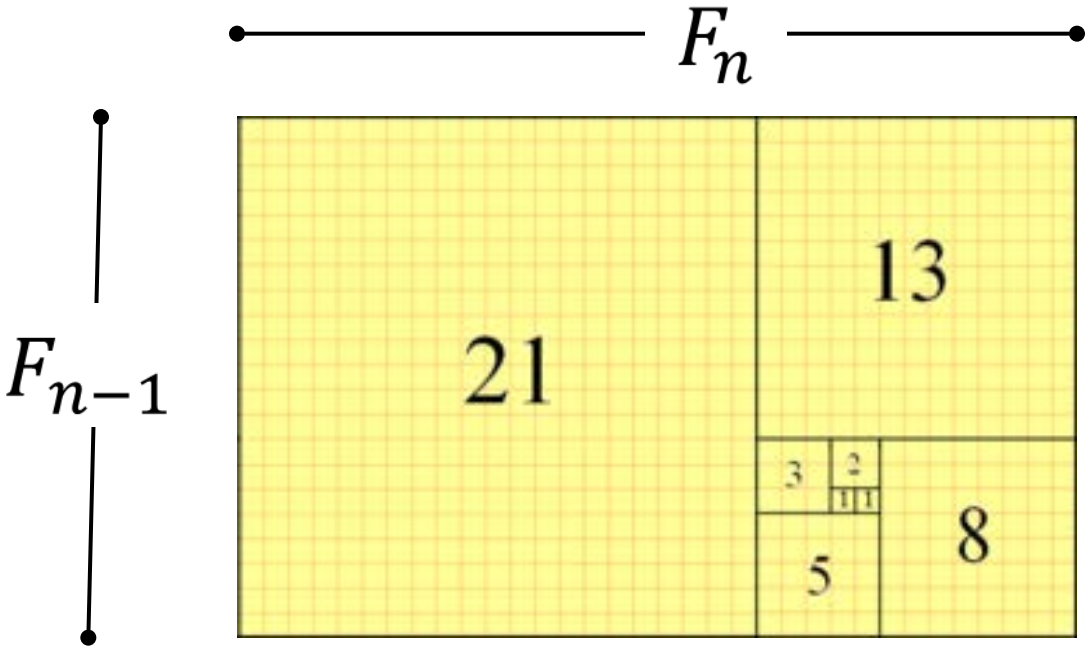

- Founded Fibonacci Quarterly Journal
- Science building named after him

# Fibonacci Numbers

$$F_0 = 0, F_1 = 1$$
$$F_n = F_{n-1} + F_{n-2}$$

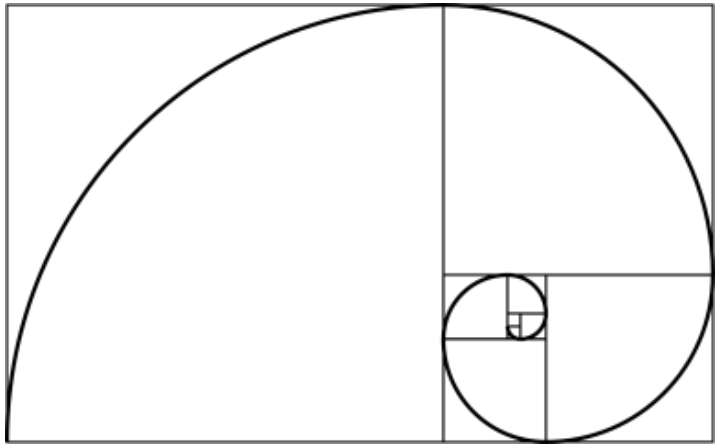
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 2 | 3 | 5 | 8 | 13 | 21 | 34 | 55 |

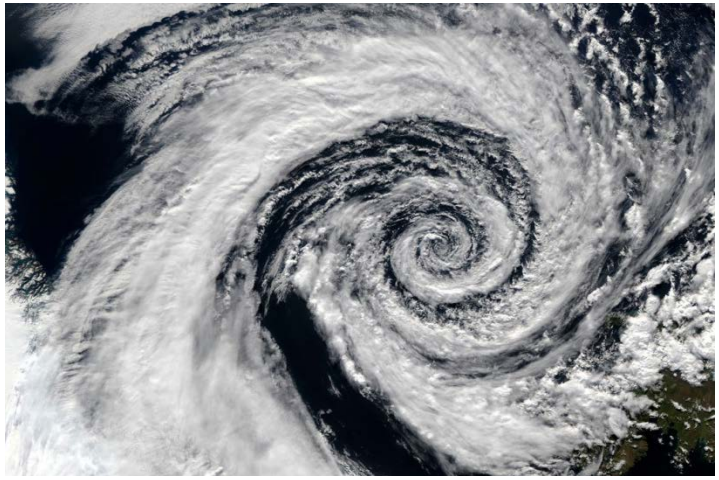
# Golden Ratio

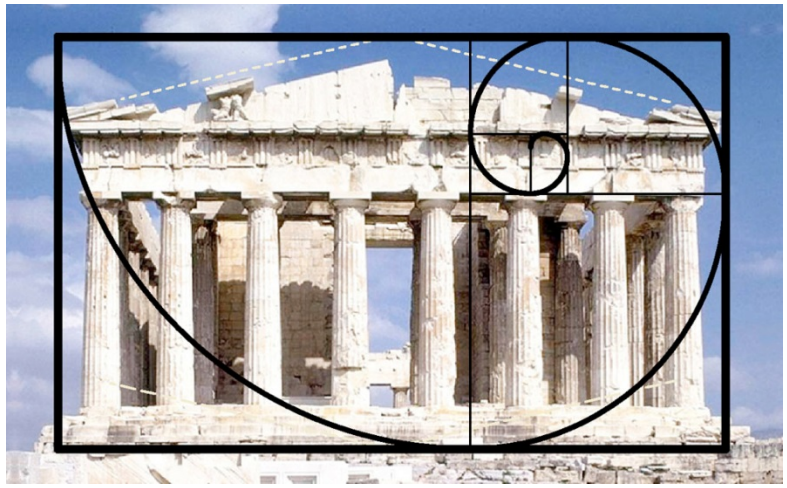



$$\frac{F_n}{F_{n-1}} \rightarrow \frac{1+\sqrt{5}}{2} \approx 1.618$$

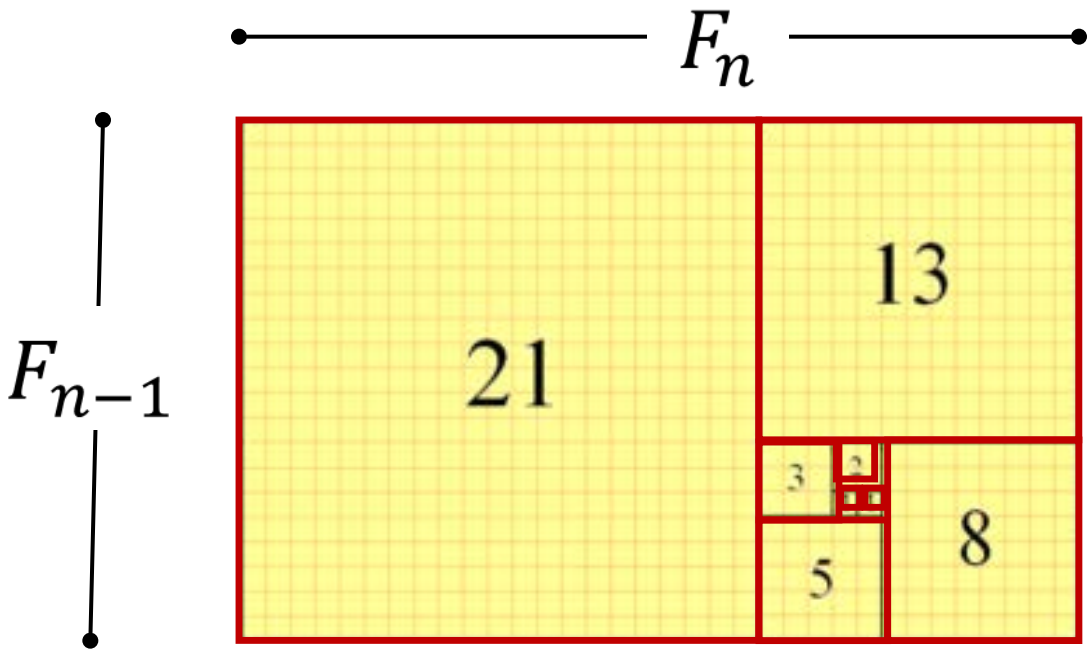
# Golden Ratio in Nature & Art







# Fibonacci Identity




$$F_n \times F_{n-1} = \sum_{i=0}^{n-1} {F_i}^2$$

# My First “Computer”


MonroeMatic Model 88N, 1950s

# University of California, Berkeley

## 1965-1971

- Mathematical Logic
- Computability

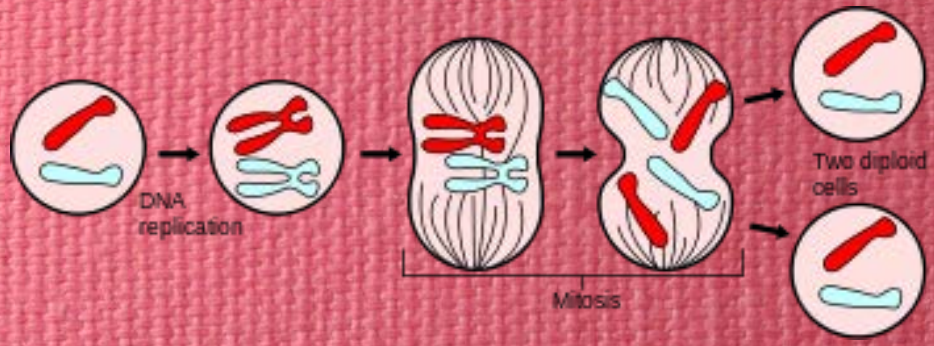
Robert W. Robinson

# Simon Fraser University
## 1970-1971

SFU

- Computability
- Completed Dissertation

Alistair Lachlan




# MITOTIC RECURSIVELY ENUMERABLE SETS

RICHARD EMIL LADNER

1971

UW

# Units

- Computer Science Group
  - 1967 - 1975
- Department of Computer Science
  - 1975 - 1989
- Department of Computer Science and Engineering
  - 1989 - 2017
- Paul G. Allen School of Computer Science and Engineering
  - 2017 - ??


PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING

# 1967 Founders

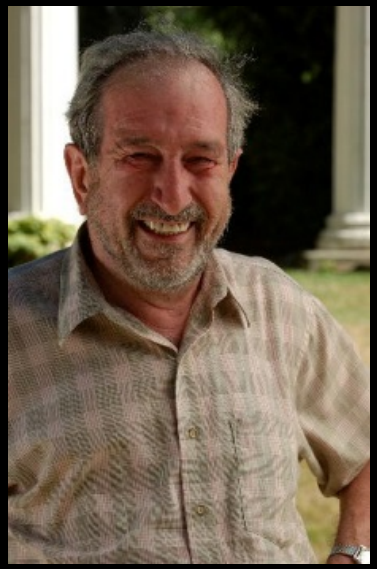
- John Cramer – Physics
- David Dekker – Math
- Hellmut Golde – EE
- Allen Goldstein – Math
- Alistair Holden – EE
- Edgar Horwood – Civil
- Earl Hunt – Psychology
- David Johnson - EE
- Ted Kehl – Physiology/Biophysics
- Laurel Lewis – EE
- Jerre Noe – CS
- Ron Pyke – Math
- R.W. Ritchie – Math
- Terry Rockafellar – Math
- Jonathan Stanfield – Library School

# The Early Hires

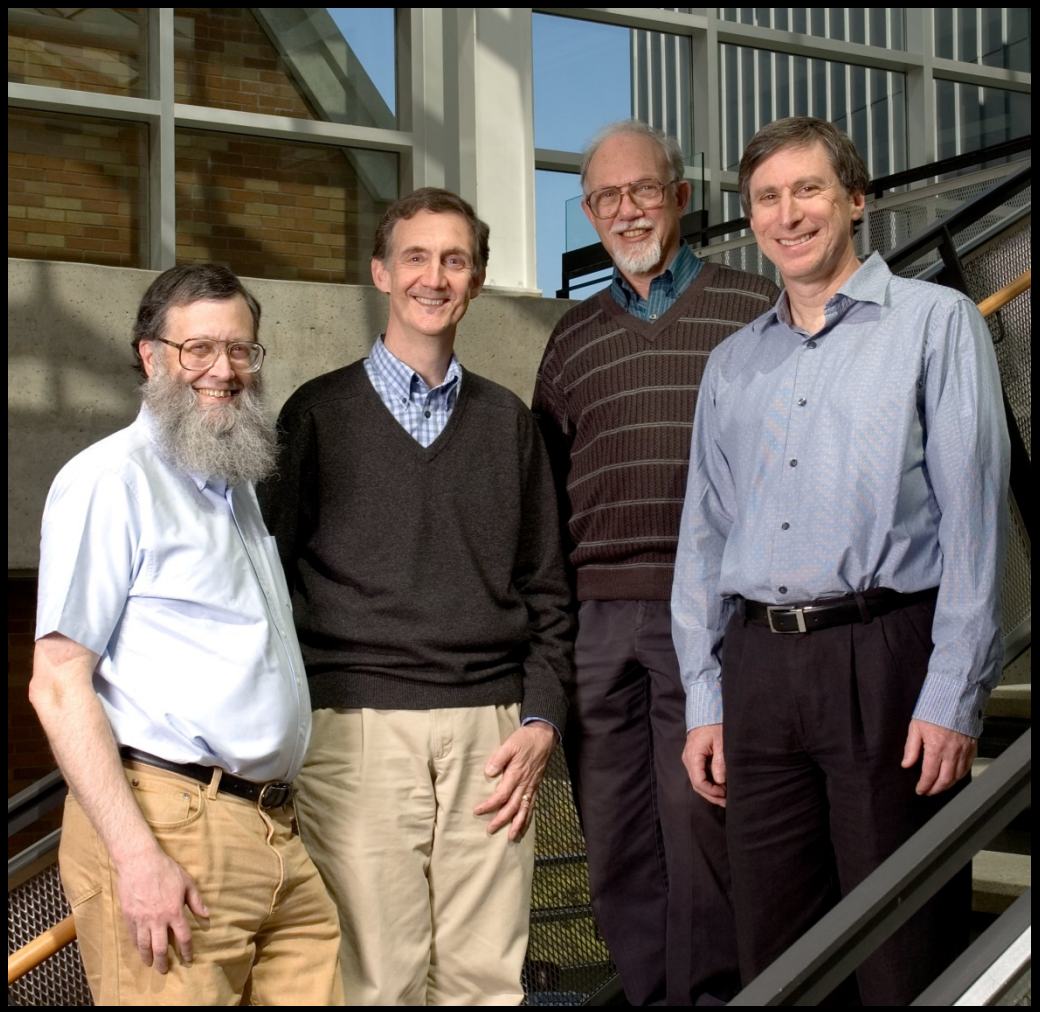
- 1968
  - Jerre Noe
- 1969
  - Jean-Loup Baer
- 1970
  - Joe Traub
- 1971
  - Alan Shaw
  - Bob Herriot
  - Richard Ladner
- After 1971
  - ~120 hires and ~60 departures

# Leaders

Noe



Golde



Notkin, Lazowska, Baer, Levy



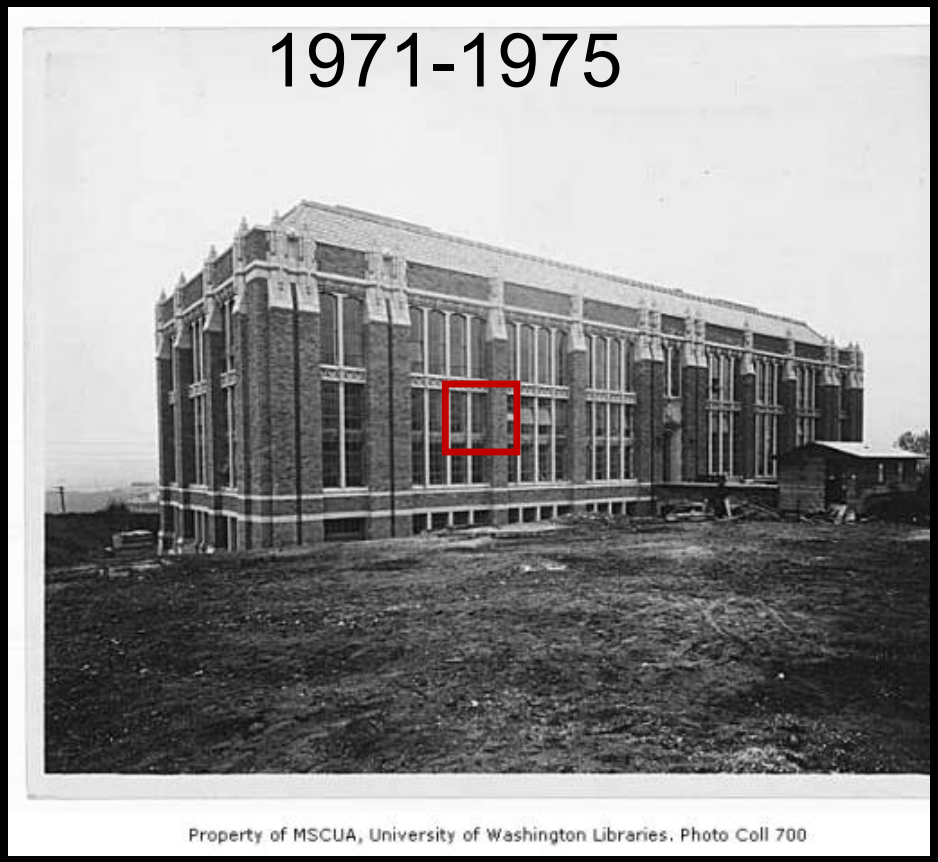





Thanks to Jim Hook

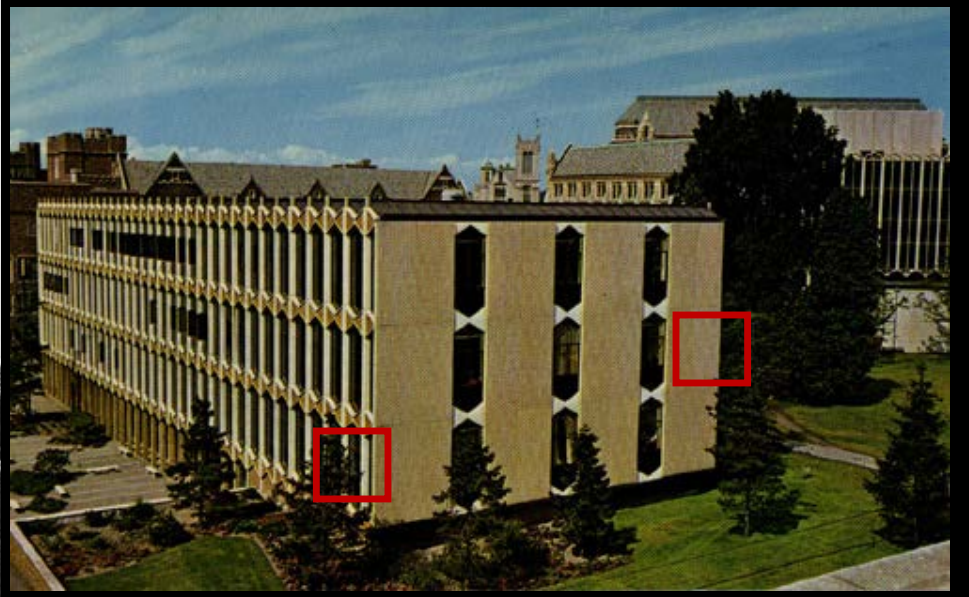
# My Offices

1971-1975




Roberts Hall, 1921

1975 - 2003

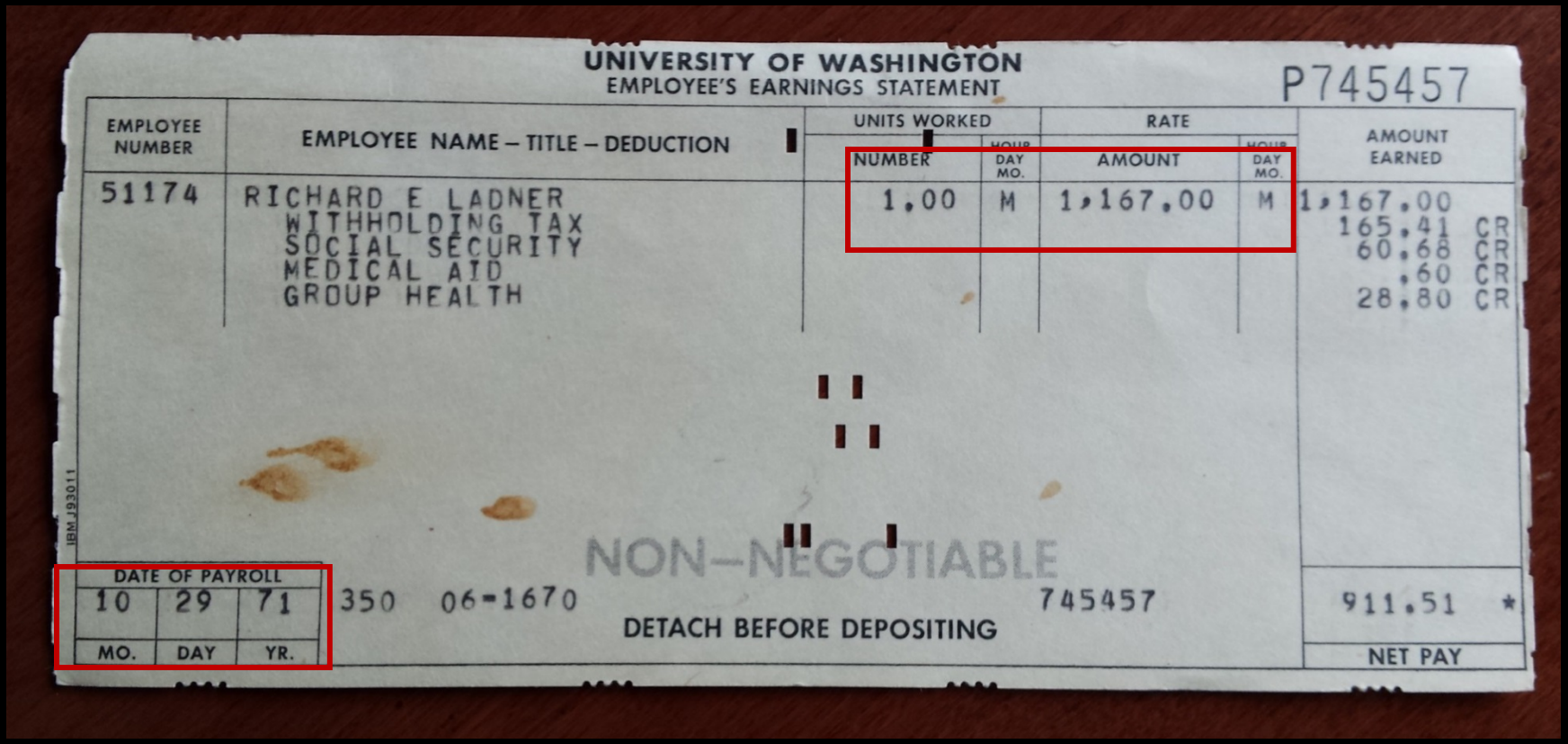


Sieg Hall, 1960

Paul G. Allen Center
for Computer Science
and Engineering
2003

New CSE building
2018

# My First Paycheck



UNIVERSITY OF WASHINGTON
EMPLOYEE'S EARNINGS STATEMENT

P745457

| EMPLOYEE NUMBER | EMPLOYEE NAME – TITLE – DEDUCTION | UNITS WORKED NUMBER | UNITS WORKED HOUR DAY MO. | RATE AMOUNT | RATE HOUR DAY MO. | AMOUNT EARNED |
|---|---|---|---|---|---|---|
| 51174 | RICHARD E LADNER | 1.00 | M | 1,167.00 | M | 1,167.00 |
| | WITHHOLDING TAX | | | | | 165.41 CR |
| | SOCIAL SECURITY | | | | | 60.68 CR |
| | MEDICAL AID | | | | | .60 CR |
| | GROUP HEALTH | | | | | 28.80 CR |

IBM J93011

NON-NEGOTIABLE

| DATE OF PAYROLL | | |
|---|---|---|
| 10 | 29 | 71 |
| MO. | DAY | YR. |

350 06-1670 745457

DETACH BEFORE DEPOSITING

911.51 *

NET PAY

# Mementos from Roberts

# SIGMA - 5

# Memento from Sieg

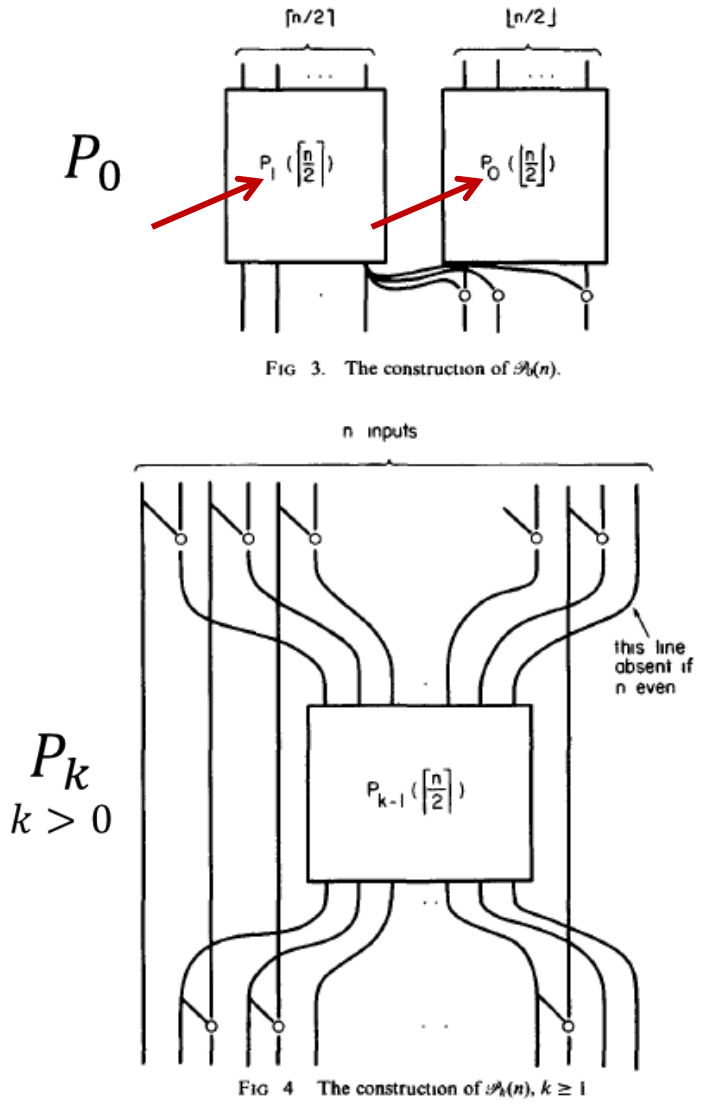
# Theory

# Fibonacci Numbers

$$F_0 = 0, F_1 = 1$$
$$F_n = F_{n-1} + F_{n-2}$$

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 2 | 3 | 5 | 8 | 13 | 21 | 34 | 55 |

# Parallel Prefix Computation




Compute in parallel

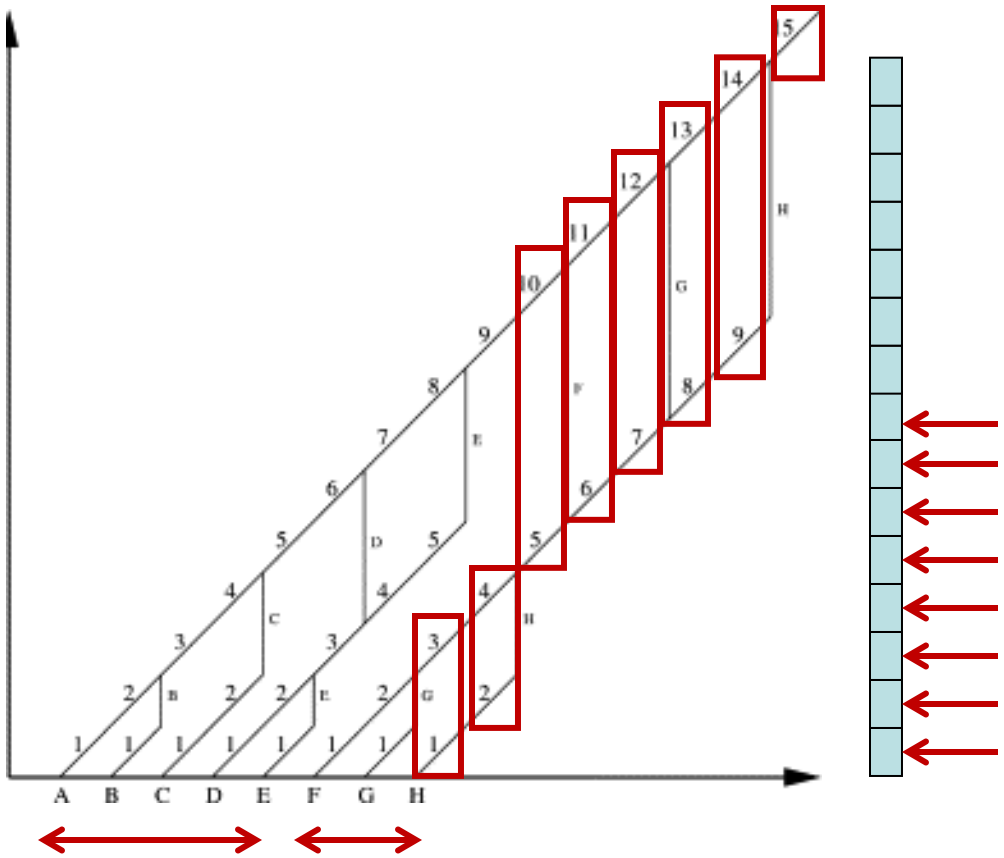
$$x_1$$
$$x_1 x_2$$
$$x_1 x_2 x_3$$
$$\vdots$$
$$x_1 x_2 x_3 \cdots x_{n-1}$$
$$x_1 x_2 x_3 \cdots x_{n-1} x_n$$

$$Depth_0(n) = \log_2 n$$

$$Size_0(n) = 4n - F(5 + \log_2 n) + 1$$

Ladner, Fischer. 1980. "Parallel Prefix Computation." *J. ACM* 27, 4 (October 1980), 831-838.

# Optimal Media Stream Merging



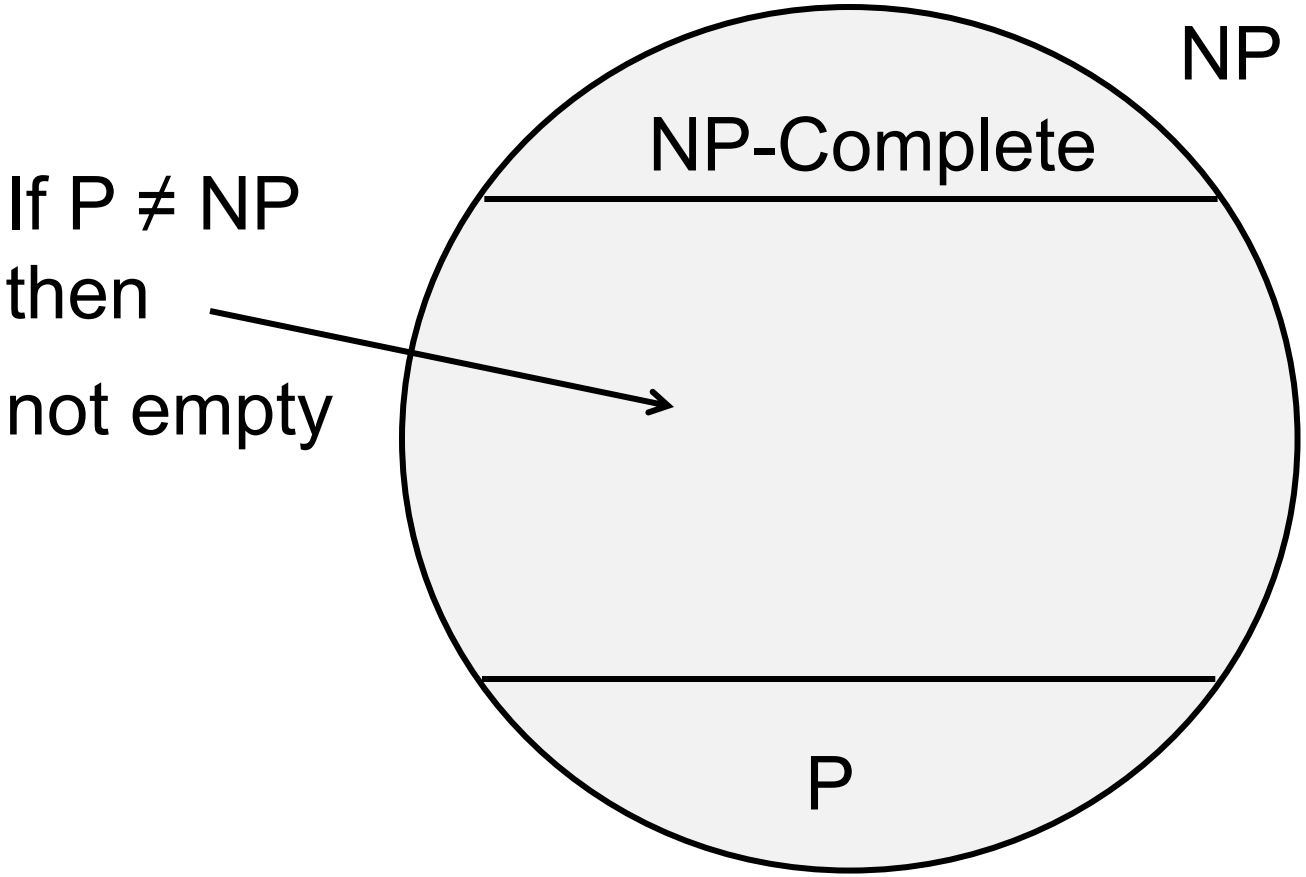

| | |
|---|---|
| 2 | {01} |
| 3 | {02} |
| 4 | {02, 03} |
| 5 | {03} |
| 6 | {03, 04} |
| 7 | {04, 05} |
| 8 | {05} |
| 9 | {05, 06} |
| 10 | {05, 06, 07} |
| 11 | {06, 07, 08} |
| 12 | {07, 08} |
| 13 | {08} |
| 14 | {08, 09} |
| 15 | {08, 09, 10} |
| 16 | {08, 09, 10, 11} |
| 17 | {09, 10, 11, 12} |
| 18 | {10, 11, 12, 13} |
| 19 | {11, 12, 13} |
| 20 | {12, 13} |
| 21 | {13} |
| 22 | {13, 14} |
| 23 | {13, 14, 15} |
| 24 | {13, 14, 15, 16} |
| 25 | {13, 14, 15, 16, 17} |
| 26 | {13, 14, 15, 16, 17, 18} |
| 27 | {14, 15, 16, 17, 18, 19} |
| 28 | {15, 16, 17, 18, 19, 20} |
| 29 | {16, 17, 18, 19, 20, 21} |
| 30 | {17, 18, 19, 20, 21} |
| 31 | {18, 19, 20, 21} |
| 32 | {19, 20, 21} |
| 33 | {20, 21} |
| 34 | {21} |
| 35 | {21, 22} |
| 36 | {21, 22, 23} |
| 37 | {21, 22, 23, 24} |
| 38 | {21, 22, 23, 24, 25} |
| 39 | {21, 22, 23, 24, 25, 26} |
| 40 | {21, 22, 23, 24, 25, 26, 27} |
| 41 | {21, 22, 23, 24, 25, 26, 27, 28} |
| 42 | {21, 22, 23, 24, 25, 26, 27, 28, 29} |
| 43 | {22, 23, 24, 25, 26, 27, 28, 29, 30} |
| 44 | {23, 24, 25, 26, 27, 28, 29, 30, 31} |
| 45 | {24, 25, 26, 27, 28, 29, 30, 31, 32} |
| 46 | {25, 26, 27, 28, 29, 30, 31, 32, 33} |
| 47 | {26, 27, 28, 29, 30, 31, 32, 33, 34} |
| 48 | {27, 28, 29, 30, 31, 32, 33, 34} |
| 49 | {28, 29, 30, 31, 32, 33, 34} |
| 50 | {29, 30, 31, 32, 33, 34} |
| 51 | {30, 31, 32, 33, 34} |
| 52 | {31, 32, 33, 34} |
| 53 | {32, 33, 34} |
| 54 | {33, 34} |
| 55 | {34} |

Bar-Noy, Goshi, and Ladner. "Off-line and on-line guaranteed start-up delay for media-on-demand with stream merging." *Journal of Discrete Algorithms* 4.1 (2006): 72-105.

# Lesson about research

The impact of a research project is not necessarily related to how hard it was to accomplish.

# Ladner's Theorem




Ladner. 1975. On the Structure of Polynomial Time Reducibility.
*Journal of the ACM* 22, 1. 155-171.


Media
Space
Coder
Proof
Threshold
Exponential
Recursive
Logic
Interactive
Distributed
Degrees
Algorithms
Complexity
Time
Mitotic
Learning
Compression
Video
Protocols
Cache
Queues
NP-Completeness
Polynomial
Parallel
Computability
Images
Scheduling
Propositional
Modal
Sorting
Completeness
Networks
Alternation
Games
Pushdown
Automata

# Migration of Early Theory Group

- Bob Ritchie → Industry
- Mike Fischer → Yale
- Larry Ruzzo → Computational Biology
- Martin Tompa → Computational Biology
- Richard Anderson → Developing World
- Richard Ladner → Accessibility

# Theory Students

# What is CS Theory

Double, double, toil and trouble.
Make this proof both long and subtle.
Throw in lemmas long and hairy
And an irrelevant corollary.
All my colleagues, I won't fear `em
Once I finally prove this theorem.

*Rob Fowler, circa 1983*
*transmitted to me by Martin Tompa*

# Accessibility

# Ephraim Glinert, 1985

# Eve Riskin, 1990

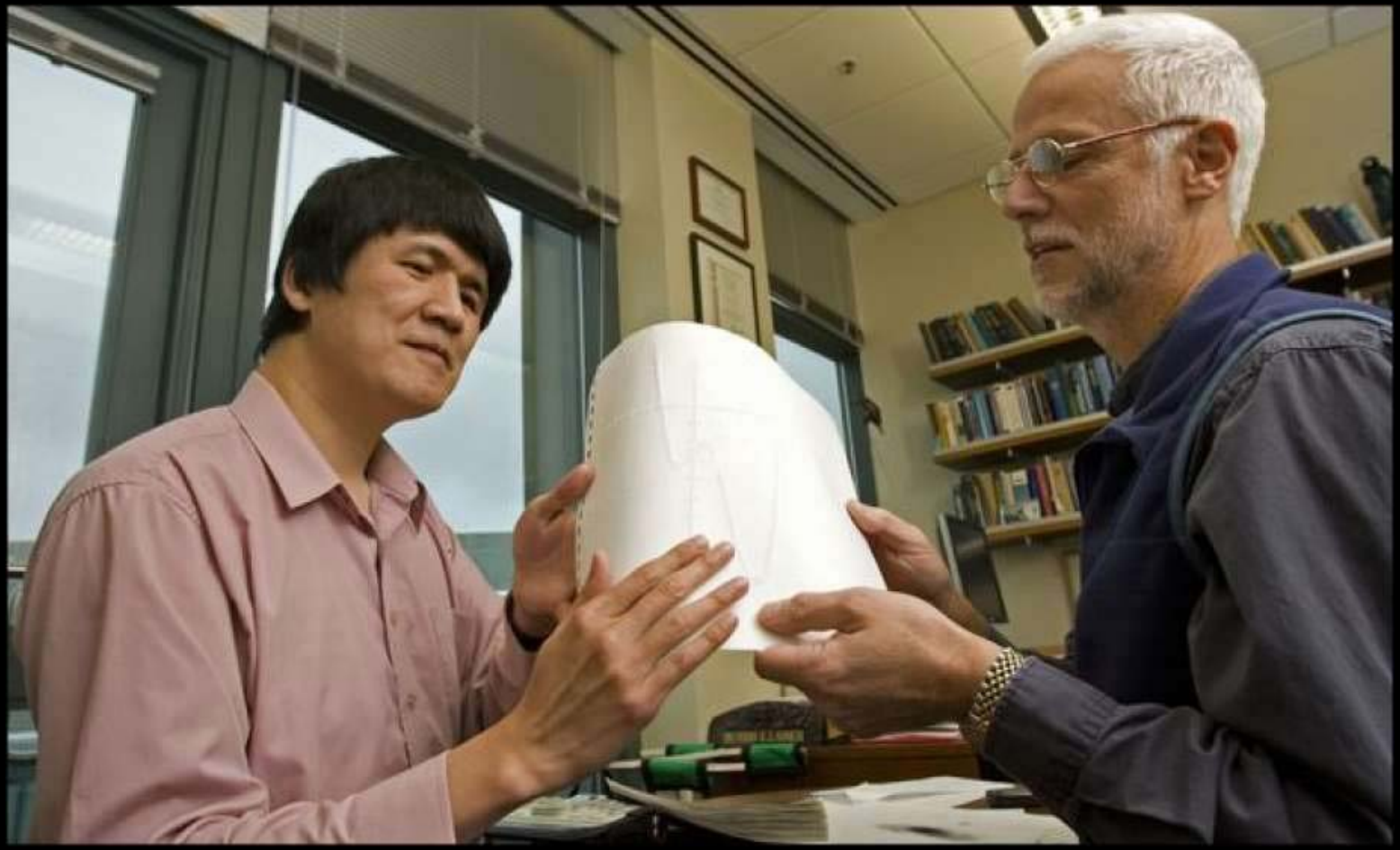
# Sheryl Burgstahler, 1992

# DO-IT Scholars

1994 - 2003

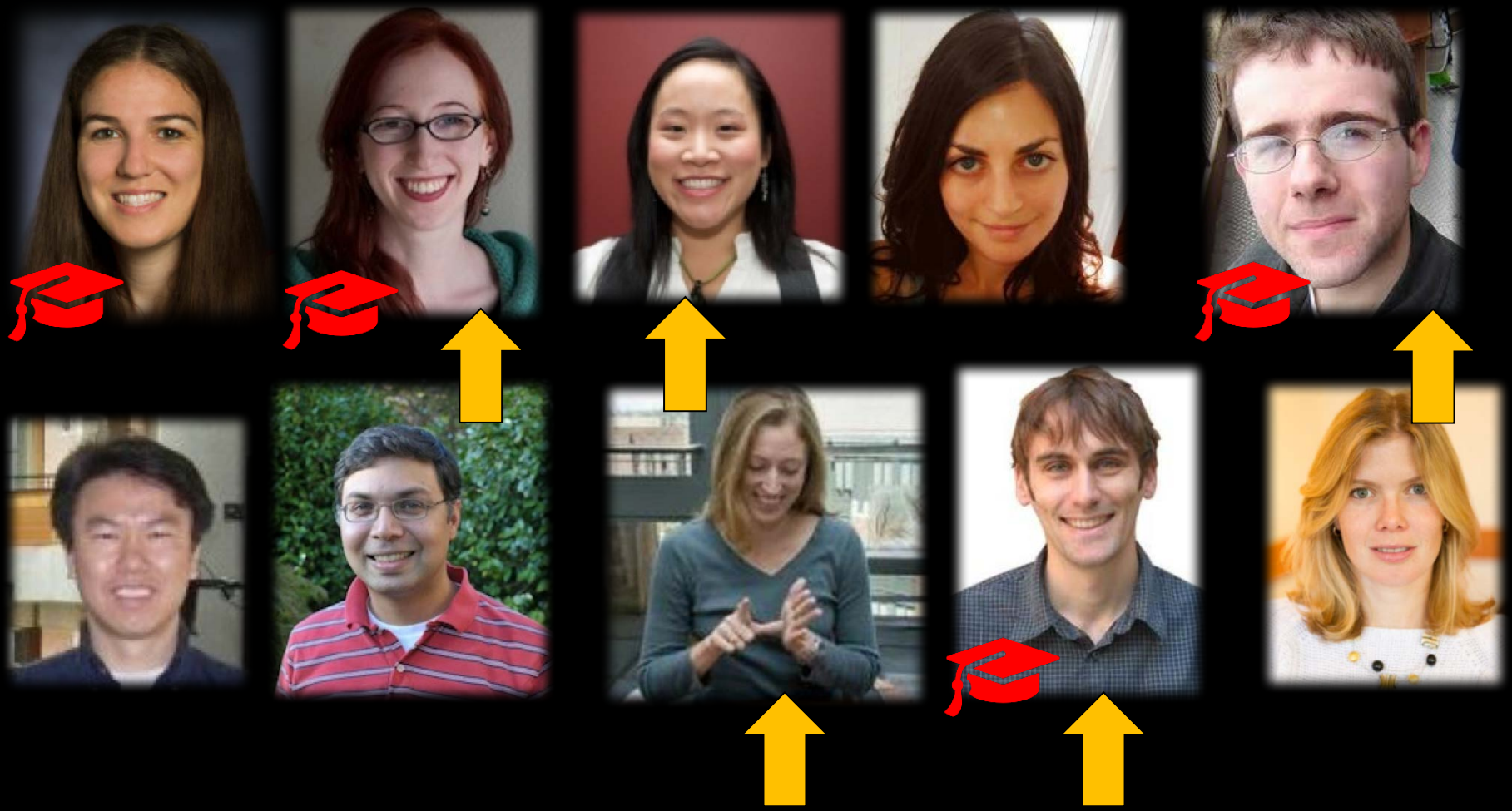

1999

# Sangyun Hahn, 2004

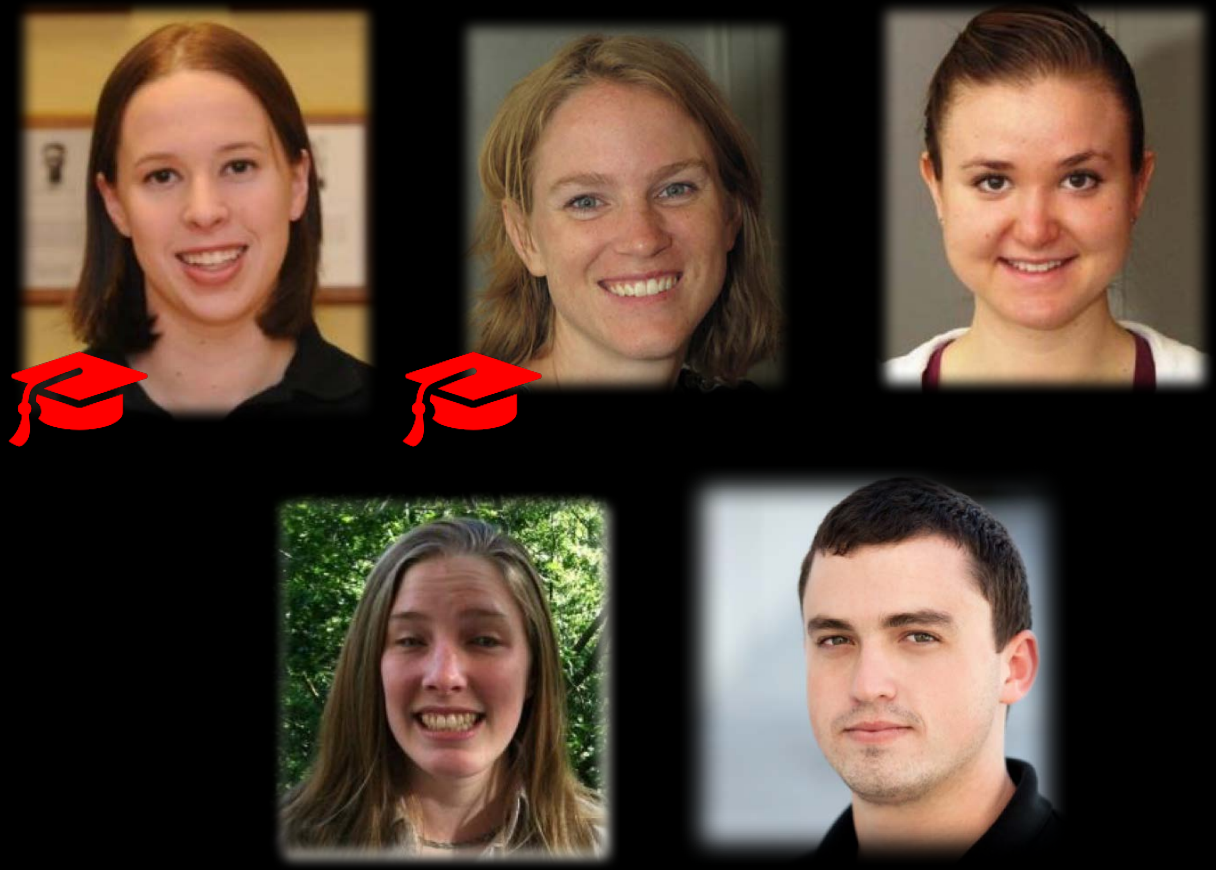


# Jacob Wobbrock, 2006

# Accessibility Students



# Current Students



# Undergraduate Research Students

- More than 100
- 23 were Mary Gates Research Scholars
- 3 Best Senior Thesis awards
- Non-UW
  - Stanford, Cal Tech, Olin, Brown, Harvey Mudd, U. of Puerto Rico, Norfolk State, Whitman

# CRA Outstanding Undergraduate Researchers

Kevin Zatloukal, 2001

Kevin Dick, 2008

# Lesson about students

- Initially, try to find a project to match a student's interests and abilities.
- In the end, the student will find their own projects and succeed.

# Accessibility Projects

# DBNet

Anne Condon, Scott Rose, Dennis Gentry, Randy Day, Karin Meyer, Anne Dinning

CHI + GI 1987

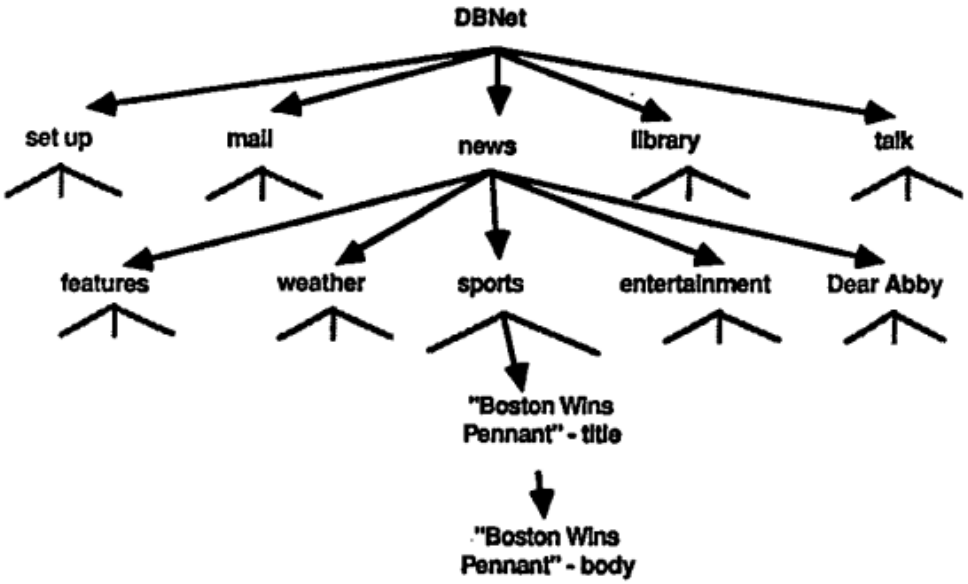
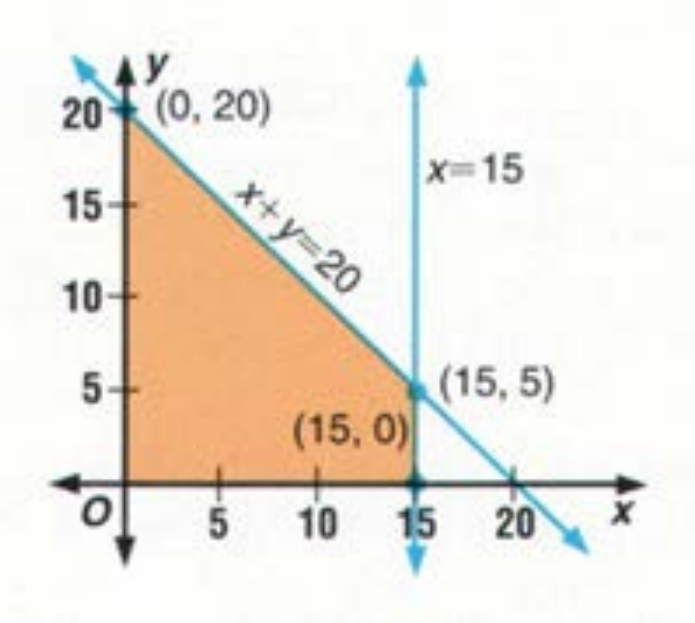
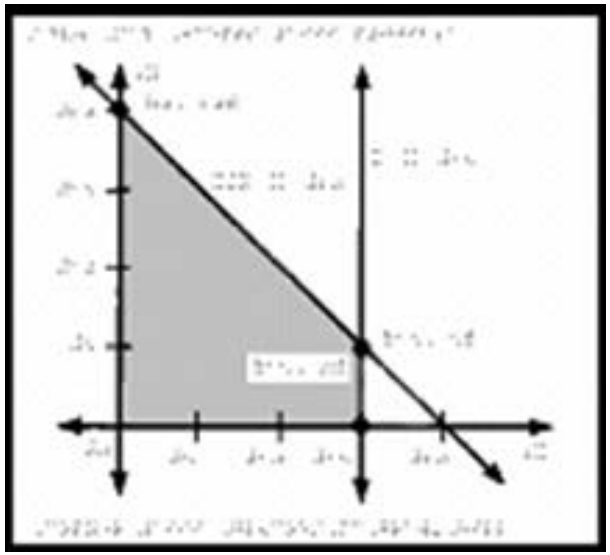



Figure 1: The Hierarchy of the DBNet system with "news" expanded.

# Tactile Graphics

Sangyun Hahn, Chandrika Jayant, Lauren Milne, Catie Baker, Ryan Drapeau, Josh Scotland, Dana Wen, Cian Malone, Satria Krisnandi, Matt Renzelmann



# MobileASL

Jessica Tran, Charles Delahunt, Katie O'Leary, Jaehong Chon, Anna Cavender, Rahul Vanam, Neva Cherniavsky, Jessica DeWitt, Sam Whittle…

# WebAnywhere

Jeff Bigham

# Perkinput

Shiri Azenkot

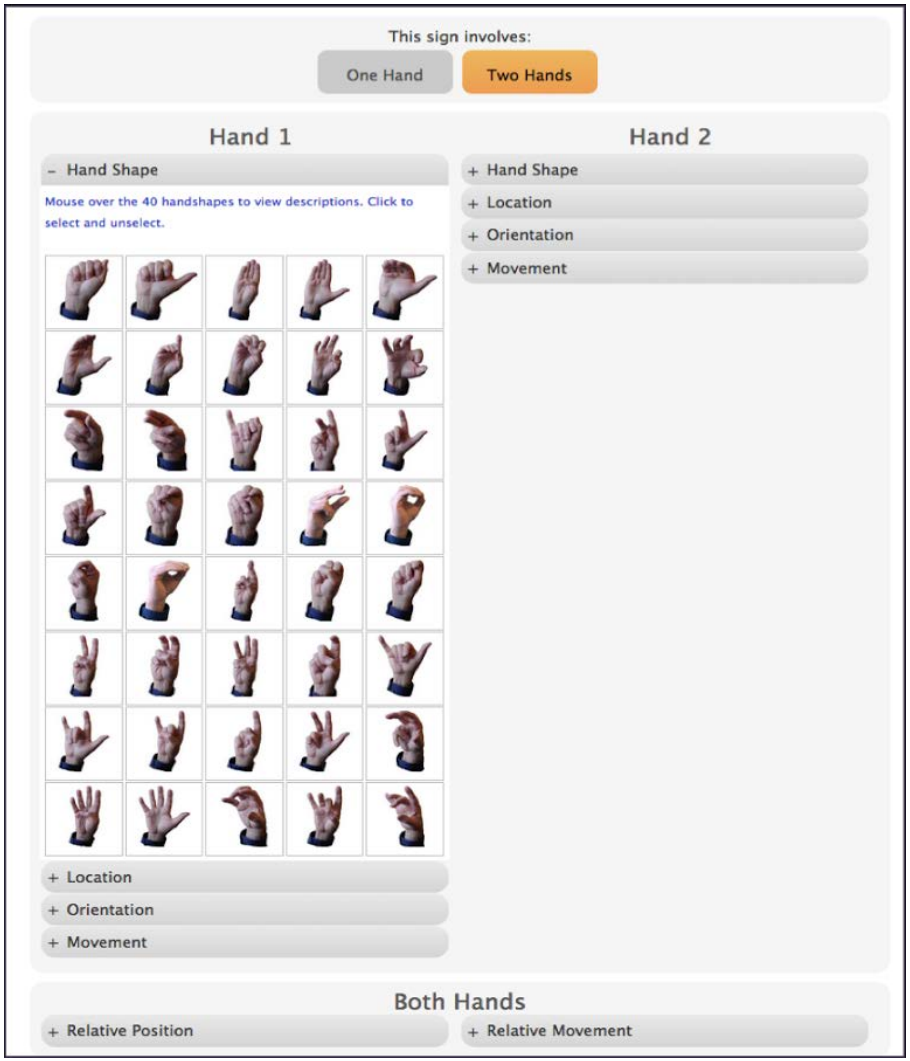

iPhone VoiceOver Text Entry


Perkinput

Demo

# ASL to English Dictionary

Danielle Bragg, Kyle Rector



# Teaching

# Graduate Teaching

- Automata and Formal Languages (8)
- Computability and Complexity* (6)
- Design and Analysis of Algorithms* (3)
- Computer Networks (3)
- Theory of Distributed Systems* (2)
- Logic in Computer Science* (1)

# Professional Masters Teaching

- Applied Algorithms*
- Data Compression*
- Computability and Complexity
- Accessibility*

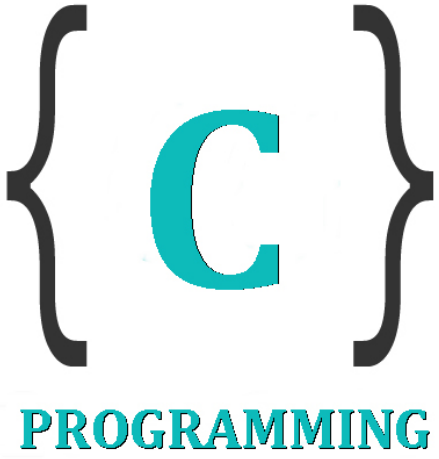
# Undergraduate Teaching

- Data Structures*(12)
- Formal Models* (12)
- Theory of Computation* (4)
- Computer Networks (4)
- Data Compression* (3)
- Algorithms (3)
- Discrete Structures (3)
- Accessibility Capstone* (3)

# Programming Languages

Fortran

PASCAL



# Lesson about Teaching

- Teach new courses now and then.
- No question by a student is stupid.

# American Sign Language at UW

# ASL at UW

- January 2005
  Sharon Hargus

- December 2006
  Ron Irving

# Our ASL Faculty

Lance Forshay
2007

Kristi Winter
2010

# Outreach at UW

# Walker-Ames Lecturers

Harlan Lane
1993

Carol Padden
2006

# AccessComputing

Founded 2006

**Richard E. Ladner, PI**
**Sheryl Burgstahler, Co-PI and Director**
**Jacob O. Wobbrock, Co-PI**
**Andrew J. Ko, Co-PI**



# Goal

Increase the participation and success of students with disabilities in computing fields.

# Summer Academy
# 2007-2013

# 2011 Summer Academy

# AccessCSForAll

Founded 2014


**Richard E. Ladner, PI**
**Andreas Stefik, PI**
**Sheryl Burgstahler, Co-PI and Director**

UNLV

# AccessCSforAll Goal

Increase the participation and success of students with disabilities in K-12 Computer Science

# Funding


DEPARTMENT OF EDUCATION
UNITED STATES OF AMERICA


NSF


IBM


Microsoft
Research


AT&T


Google


GALLAUDET
UNIVERSITY


intel


MSRI
Mathematical Sciences
Research Institute


Adobe


Washington Research
FOUNDATION


Fetzer Institute


BILL & MELINDA
GATES foundation


JOHNSON SCHOLARSHIP
Foundation

# Beyond UW

# My Sign Language Teachers

Larry Petersen

Marilyn Smith


Theresa Smith

adwas

abused Deaf women's advocacy services

# DEAF-BLIND SERVICE CENTER

Empowering Deaf-Blind Individuals and the Deaf-Blind Community

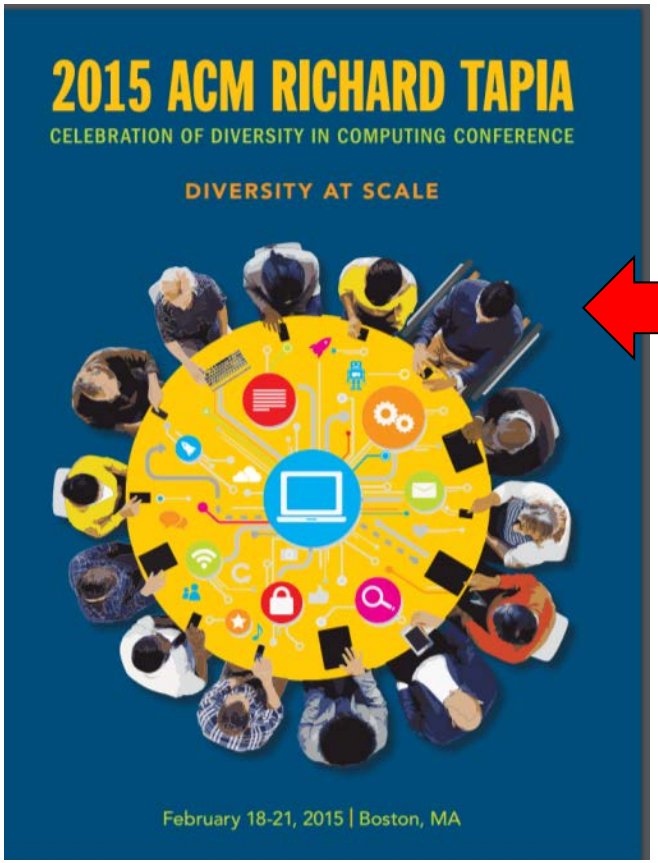
# GALLAUDET
## UNIVERSITY

CMDiT

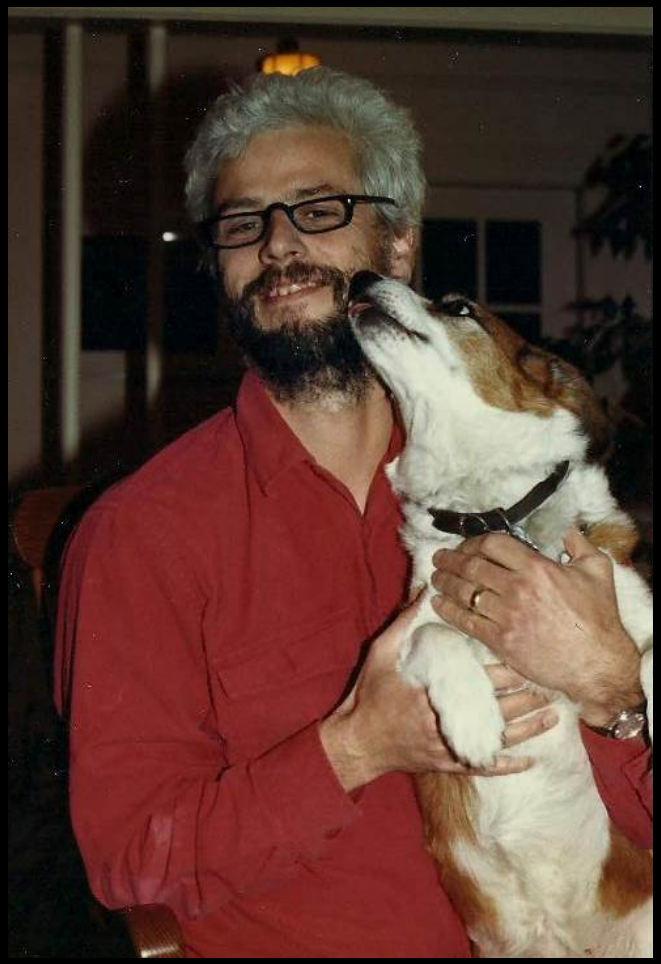
Center for Minorities and People with Disabilities in IT

*Fostering Innovation Through Inclusion*

Valerie Taylor



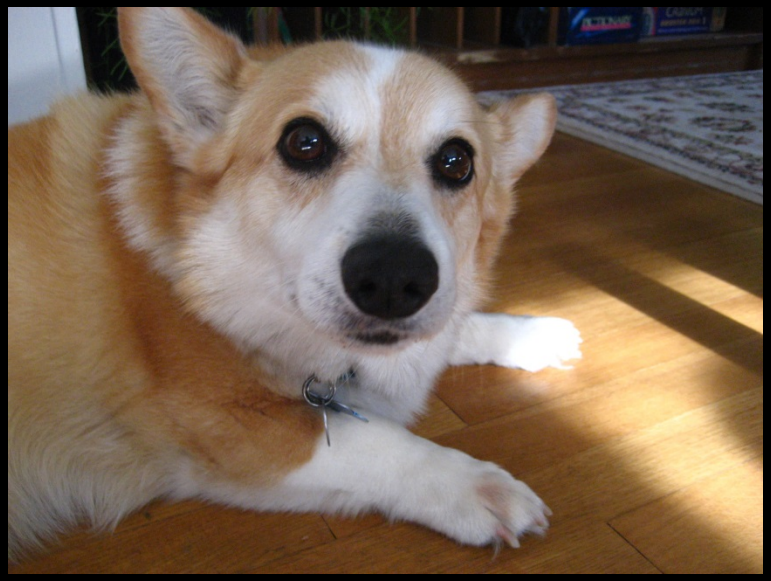
# Shaka



# More Dogs

Ginger

Abby



Lewis

Thanks to all who helped me on this journey