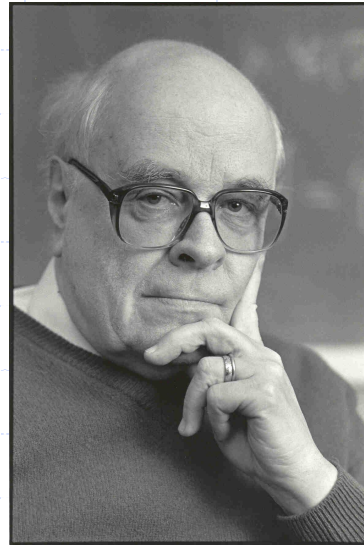




ULF GRENANDER

MEMOIRS OF A HAPPY LIFE



By Anuj Srivastava



SOURCES

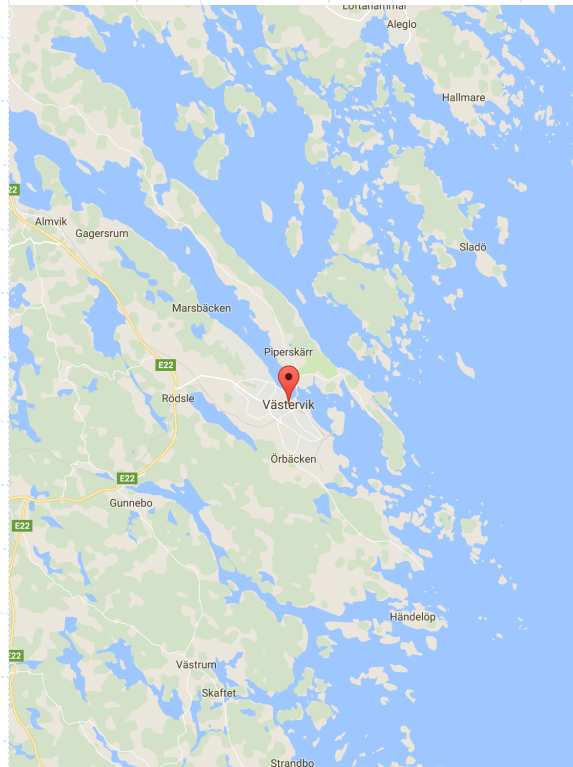
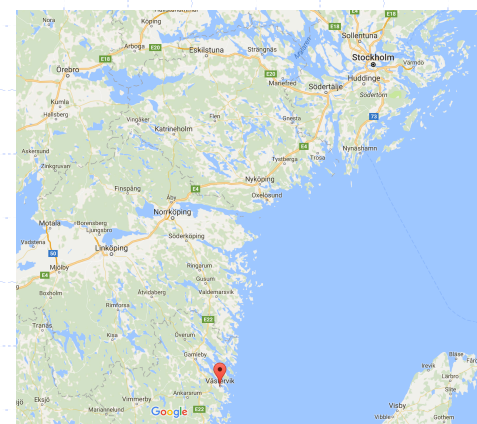
- *Memoirs of a happy life* – Ulf Grenander (copy courtesy Angela Grenander)
- *Obituary: Ulf Grenander*, by Stu Geman in IMS Bulletin, April 1, 2017.
- *A Conversation with Ulf Grenander by Nitis Mukhopdhyaya*, Statistical Science, 2006.
- Personal Picture Collection of Sven Grenander
- *A Tribute to Ulf Grenander* by David Mumford.



HOME TOWN – VASTERVIK/GRANSO

➤ Born in July 1923 in a small Swedish town called Vastervik.

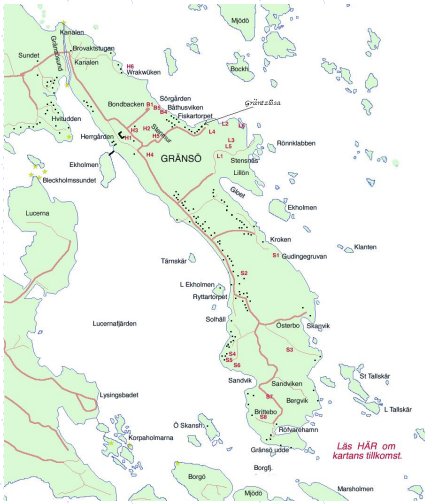
My childhood was idyllic and uneventful





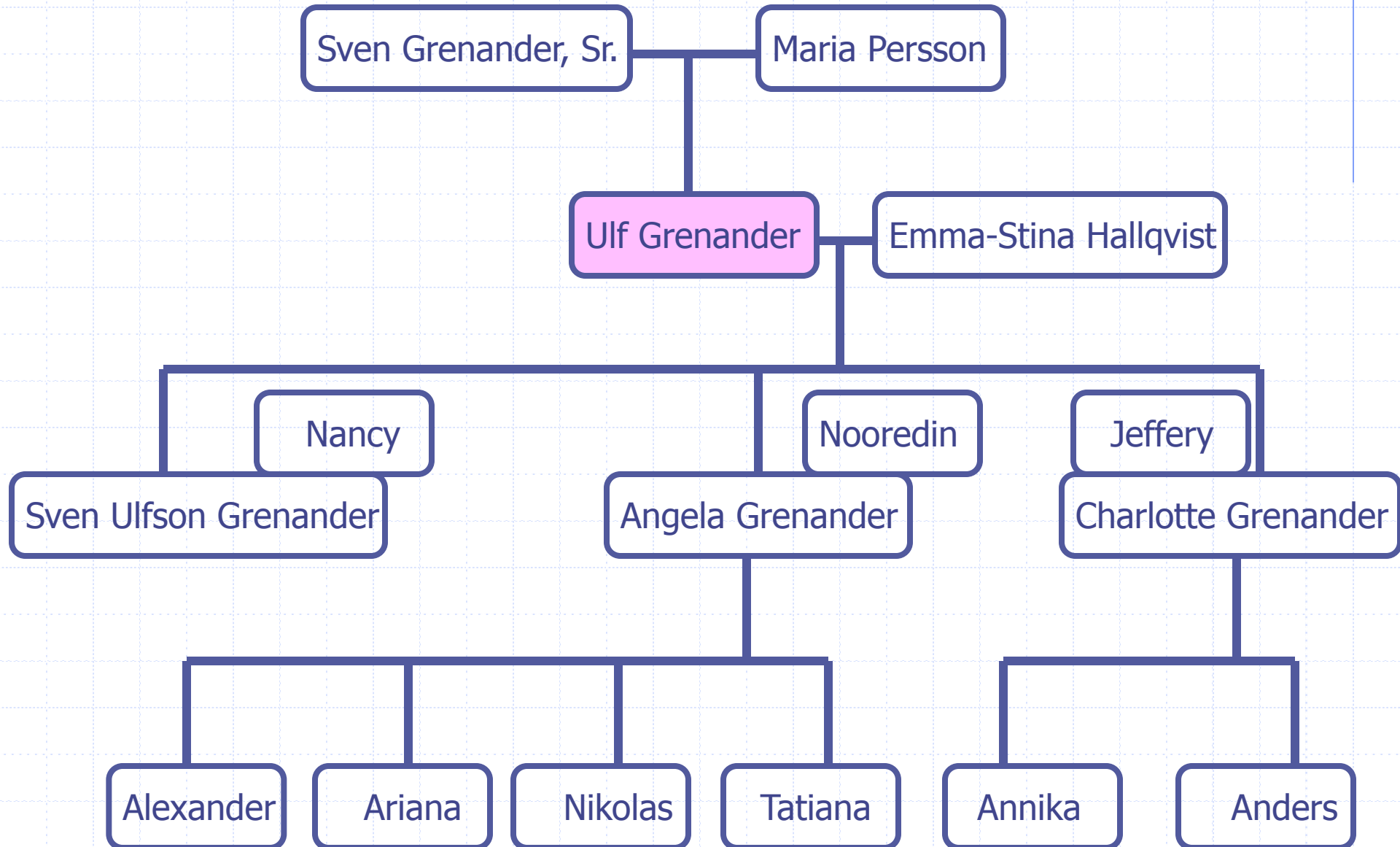
HOME TOWN – VASTERVIK/GRANSO

➤ Summer home in Granso, next to Vastervik





GRENANDER FAMILY





FAMILY

- Father: Sven Sr, Sailing Pioneer,
 - Founder of Swedish Yacht Club, became largest in the world. A prize named after him – Grenander medal
 - One of the first in Sweden to obtain a level that would be considered equivalent to a PhD in mathematics.
 - Lived to the age of 96. On being 95 -- “It is OK but the first 90 years were the best..”
 - *“I learnt more from his dinner monologues than from dry knowledge received at school Dinner topics: Mendelian genetics, expansion of universe”.*





FAMILY

➤ Mother: Maria Persson





FAMILY

➤ Brother: Nils Grenander

“...*who was a real rascal*”. He was adventurous. As a 15 year old he planned a bike trip to Africa. He reached as far as Austria, got a sun stroke and was sent home by the Swedish Consulate.

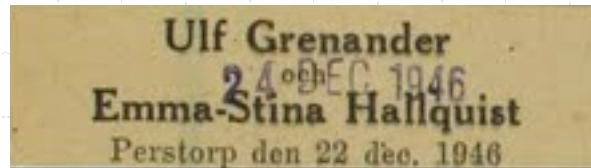
Was a lawyer and became a CEO of Swedish ship owners.





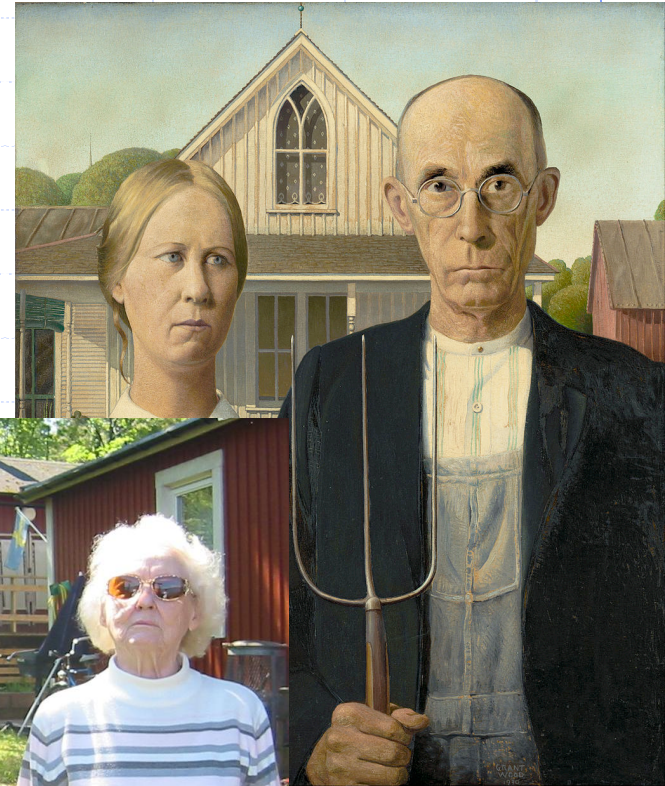
FAMILY: PAJ

- Wife: Paj, a medical doctor trained at the Karolinska Institute in Stockholm.
 - *She has taken such a good care of me; she even does our taxes.*





FAMILY: PAJ

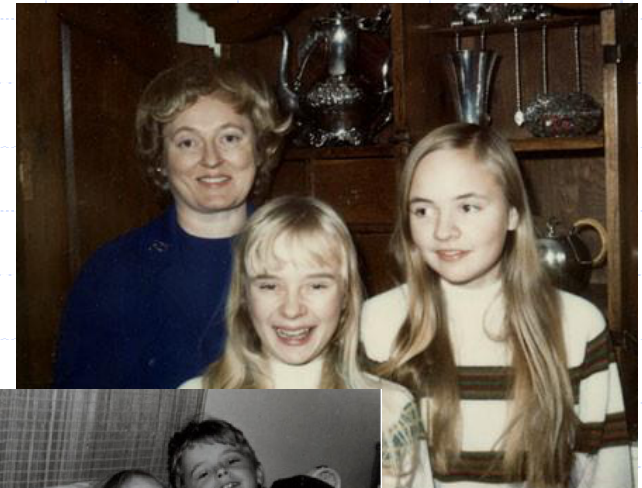


Swedish Gothic



FAMILY: THREE CHILDREN

- **Sven:** Worked at Jet Propulsion Lab, Married to Nancy, also into sailing
- **Angela:** Pediatrician in Rhode Island, married to Noori, also an MD
Four children: Alexander, Ariana, Nikolas, and Tatiana
- **Charlotte:** Married to Jeffery
Two children: Annika and Anders





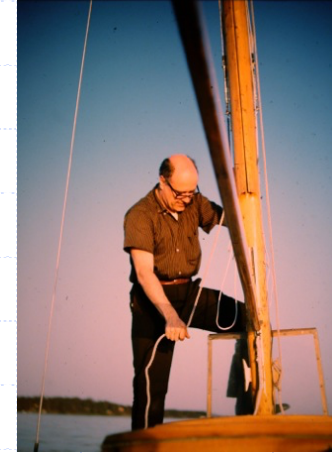
FAMILY: THREE CHILDREN





HOBBIES

➤ Sailing





OTHER LOVES

➤ Mathematics:

Mathematics is my hobby. I can't believe that they pay me to pursue my hobby.

➤ DIY: Repairing his first car



➤ Dogs: Rufsum, Kettu





TIMELINE – (1923-2016)

- School in Vastervik
- Undergraduate at Uppsala:
 - B.A 1946
- Graduate School at University of Stockholm
 - Licentiate of Philosophy 1948
 - Doctor of Philosophy 1950
- University of Chicago 1951-52: Visiting Assistant Professor
- Univ. of California, Berkeley 1952-53: Visiting Associate Professor
- University of Stockholm 1953-57: Docent
- Brown University 1957-58: Prof. of Probability and Statistics
- University of Stockholm 1958-66:
 - Prof. and Director of Institute of Insurance Mathematics and Mathematical Statistics
- Brown University 1967-200X:
 - L. Herbert Ballou Prof. of Division of Applied Mathematics



EARLY EDUCATION

➤ Elementary School:

When I entered elementary school... I could already read. My brother Nils had taught me to read without anyone noticing. ... I was reading editorials in newspapers.

➤ Middle School:

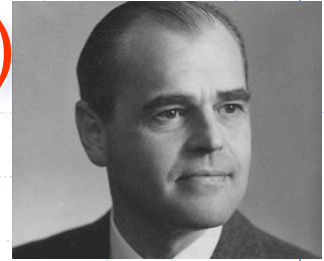
- *Middle school was less interesting, just studying several foreign languages: German, English, French, Latin, Norwegian, Danish.*
- *I spent time doing scientific experiments. Among other things I had bought three strong acids. Made some marks in my mother's closet floor.*
- *My hobby was electricity/radio experiments, using old used radios that I got from the store.*

➤ High School:

- *The condom story!*



Uppsala: Undergraduate (194?-46)



➤ Uppsala University:

- *An overwhelming experience in Uppsala was my encounter with mathematics professor Arne Beurling, ...perhaps one of the greatest cryptographers.*
- *Allowed me to attend graduate seminars". "The seminar met at 8:00am...Once I was the only one attendant. Still the professor spoke for 90 minutes.*
- *I never met anyone who radiated more intellectual power as he did!*
- First scientific paper "Sur les series asymptotiques de M. Hadamard".

Military service – One year of military service (46-47)

It was not bad! I discovered the pleasures of outdoor life instead of being a nerd.



Stockholm: Graduate School (1948-50)

➤ Stockholm University:

Worked with Prof. Harald Cramer,

PhD dissertation: Stochastic Processes

Papers: Stochastic processes and integral equations, 1949
Stochastic processes and statistical inference, 1950.

Gained attention from Neyman in Berkeley and Kolmogorov in Moscow.

Kolmogorov visited us in Svetsa. I admired his work, he was the greatest living probabilist.

Learned insurance mathematics. Played with the idea of going into insurance industry. Karhunen, who worked in insurance industry and played a role in his dissertation defense.





INFLUENCE OF COMPUTING

- “During my first scientific conference in Copenhagen
(I was a soldier in the army but was allowed a week’s leave so I could go with Paj to Copenhagen)

I heard a talk by an American Professor Henry Wallman, who gave a thought provoking lecture about the computer of the future. He said there would be program libraries for computing cosine, square-roots, etc. I was overwhelmed.....

- Computational Spearhead: Grenander-Miller, JRSS Read Paper 1994
- Precursor of particle filtering – Jump-Diffusion processes. Bayesian inference, compute it all!

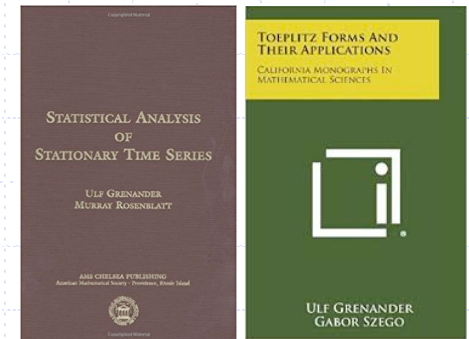


UNIVERSITY OF CHICAGO (1951-52), BERKELEY(1952-53)

- Murray Rosenblatt:
Wrote my first book: "Statistical Analysis of Stationary Time Series".
Not a masterpiece but seems to have had a considerable influence.
still in print.

- Jerzy Neyman: the founder of mathematical statistics

- Gabor Szego: Met him at a joint seminar with Stanford while at Berkeley
Wrote a book "Toeplitz Forms and Their Applications"



Job offer to work permanently at Berkeley, but Paj wanted to go back.
First return to Sweden (53-57)!



BROWN & then SWEDEN

- *William Prager offered me a job at Brown. It was an offer I could not refuse, so we took off again for America.*
- (1957) Traveled on "Northern Clipper", a big boat with only few passengers!
- At Brown, he taught probability and statistics, rekindled a long-standing fascination with computing, thanks to resources from IBM
- (1958-66)
- Got a call from Cramer that he has been made Chancellor of all Swedish Universities. Cramer would retire from his professorship. Cramer expected Ulf to become him successor, and he did.
- Became director of the Institute for Insurance Mathematics and Mathematical Statistics, University of Stockholm





EXPERIENCES IN SWEDEN

➤ Consulting analyst with Naval Staff in Stockholm

One of his contributions to artillery tactics was “distribution of fire”

Problem: Naval guns were extremely accurate while the radar detecting enemy plane were not. Probability of hitting was small.

Ulf suggested spreading out the fire, and Admiral admitted that there was something in the idea.

Later, Swedish intelligence discovered a Russian manuscript containing the same ideas. The author was Kolmogorov!



EXPERIENCES IN SWEDEN

- Also worked as a mathematical consultant. At first it dealt with medical statistics.
- *I must have been doing 500 analyses of variance, something that I am not proud of since I have later developed a healthy skepticism toward standard biometric practice. But, I was well paid so I should not complain.*
- I spent some time as a consulting actuary.
- *I discovered that there were some inviting problems in mortality measurements and proved a theorem that has generated quite a literature outside of insurance.*

On the theory of mortality measurement, part I, Skand. aktuarietidskr. 39, 70-96, 1956.

On the theory of mortality measurement, part II, Skand. aktuarietidskr. 39, 125-153, 1957.

Birth of shape-constrained density estimation,



RETURN TO BROWN

- 1966-retirement
- Named L. Herbert Ballou Professor at Brown until his retirement
- Second time around the place was more collegial.
- Worked with Walter Freiberger who was head of the computing group. Together they a book on computational solutions.
- *Most of my efforts since moving to Brown in 1966 have gone into creating a mathematical theory of patterns, starting from algebraic considerations, based on which are probabilistic results (metric pattern theory) and methods of inference (pattern inference). The latter are implemented as algorithms and computer programs intended to analyze and understand patterns of various types: pictures, syntactic patterns, logical structures, social systems, and patterns of doctrines.*



A TRIBUTE TO ULF GRENANDER

DAVID MUMFORD

"For about 50 years, from around 1965 to his death, Ulf's principal research interest was the area he created and called Pattern Theory. This tribute will deal only with this part of his work as this is the topic I know well and the one we discussed from our first meeting in the early 90s when we were both supported by the same Army Research Grant. But I always need to understand new ideas on the basis of something concrete, hence my interest was initially only in applying Pattern Theory ideas to vision. Much later I took up his ideas on shape and on grammars for vision and even for general AI, but for a long time, I didn't grasp how Pattern Theory, in Ulf's hands, sought to encompass such a truly vast array of human studies. Let me do my best here to describe his vision."

PDF file ForUG.pdf available to read.



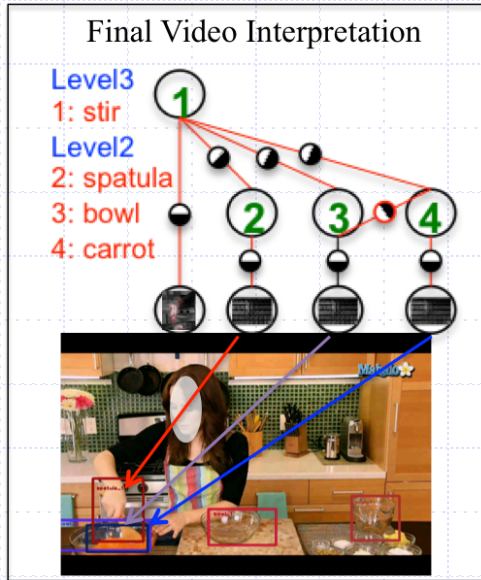


PATTERN THEORY

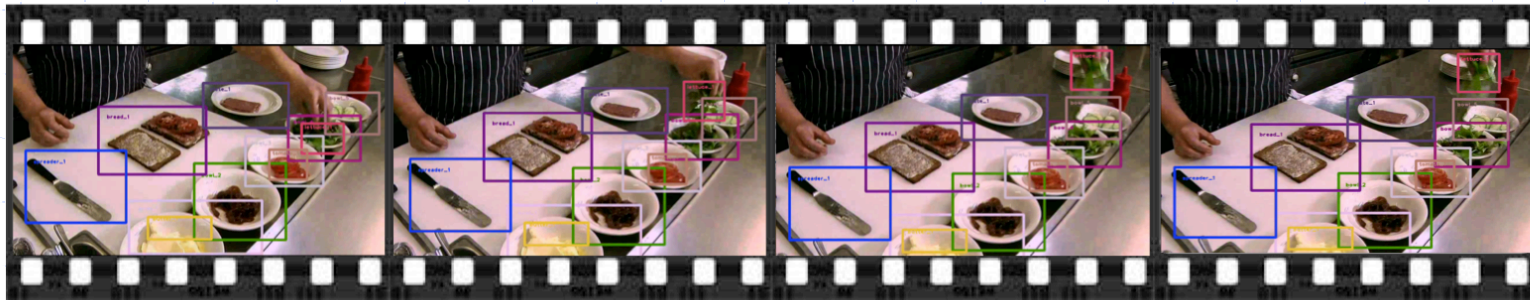
- Create **algebraic structures** that can represent patterns in great generality.
- Introduce and study **probability measures on them** that will fit the algebraic properties and that represent pattern variability
- Deduce **methods for pattern inference** and apply them to concrete situations.
- Finally, derive tools that will help us in creating adequate regular structures when empirical information is available.



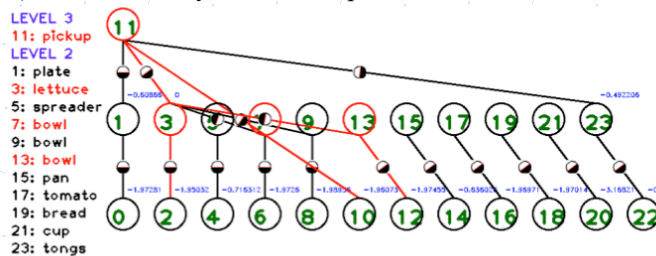
PATTERN THEORY



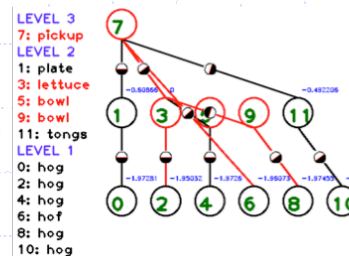
a) Sequence of frames depicting the contents of a video shot: “pick up lettuce from bowl”



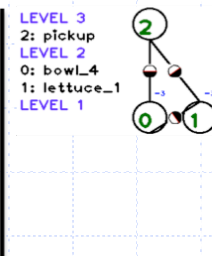
b) Pattern Theory-based Interpretation



c) Largest Connected Component



d) Ground-truth Interpretation





MANY RECOGNITIONS

➤ Prizes:

Arhennius Fellow (1948),
Fellow of the Institute of Mathematical Statistics (1953),
Prize of the Nordic Actuaries (1961),
Arnberger Prize of the Royal Swedish Academy of Science (1962),
Member of the Royal Swedish Academy of Science (1965),
Guggenheim Fellowship (1979)
Honorary Fellow of the Royal Statistical Society, London (1989).

- He delivered numerous prestigious lectures, including the Rietz Lecture (1985), the Wald Lectures (1995), and the Mahalanobis Lecture (2004).
- He received an Honorary D.Sc. degree (1993) from the University of Chicago and is a Fellow of both the American Academy of Arts and Sciences (1995) and the National Academy of Sciences, U.S.A. (1996).
- Not enough recognition of what he has produced.



MATHEMATICAL GENEALOGY

Ulf Grenander

[MathSciNet](#)

Ph.D. **Stockholm University** 1950



Dissertation: *Stochastic Processes and Statistical Inference*

Advisor: [Harald Cramér](#)

Students:

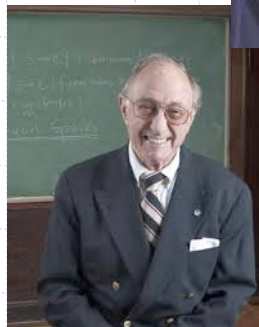
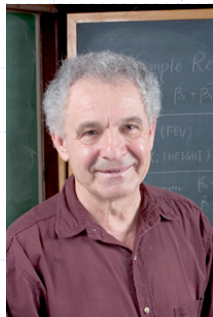
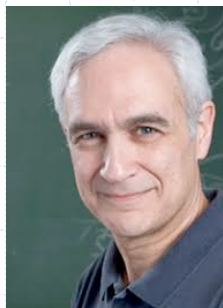
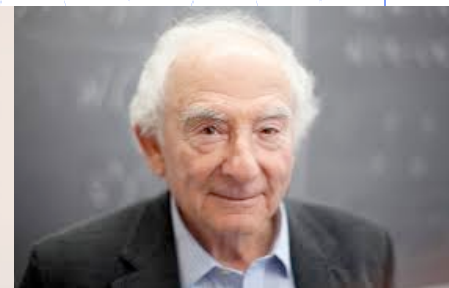
Click [here](#) to see the students listed in chronological order.



Name	School	Year	Descendants
Ang, Beng-Tung	Brown University	1974	
Barat, Christopher	Brown University	1989	
Bates, Richard	Brown University	1980	
Bourke, Patrick	Brown University	1974	
Chow, Yun-shyong	Brown University	1980	
Erlander, Sven	Stockholm University	1968	60
Frolow, Igor	Brown University	1978	
Gischner, Burton	Brown University	1972	
Goldstein, Richard	Brown University	1972	
Hennen, John	Brown University	1972	
Hwang, Chii-Ruey	Brown University	1978	
Knoerr, Alan	Brown University	1988	
Kowalczyk, Robert	Brown University	1972	
Lavin, Philip	Brown University	1972	
Lin, Wen-Te	Brown University	1974	
McClure, Donald	Brown University	1970	14
Osborn, Brock	Brown University	1986	
Shrier, Stefan	Brown University	1977	
Silverstein, Jack	Brown University	1975	2
Thrift, Philip	Brown University	1979	
Town, Donald	Brown University	1978	
Vitale, Richard	Brown University	1970	5



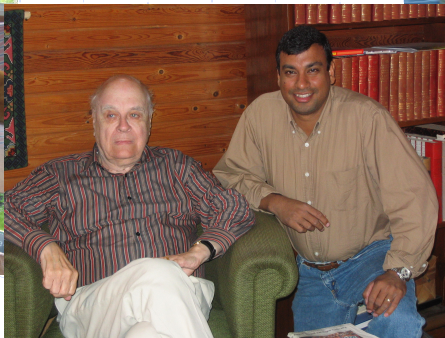
COLLEAGUES AT BROWN & OUTSIDE





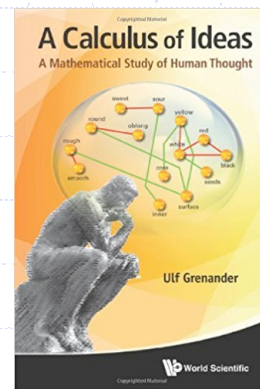
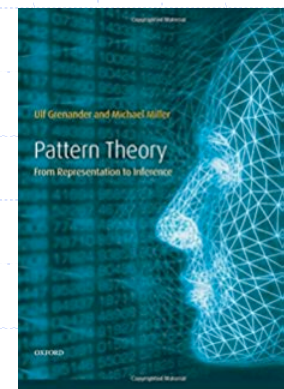
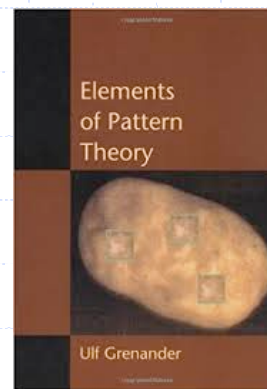
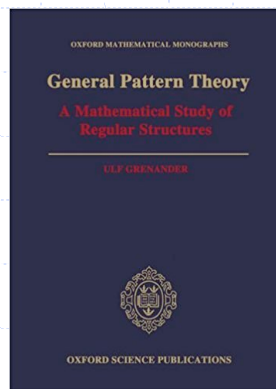
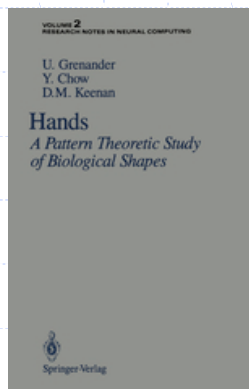
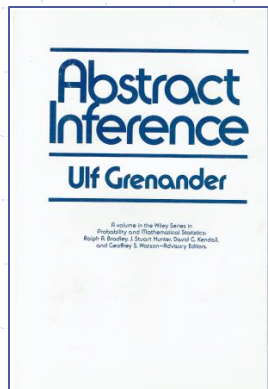
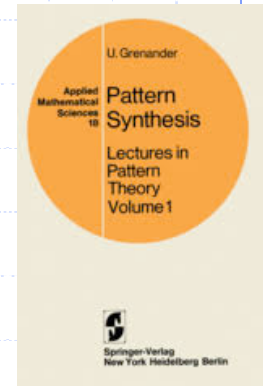
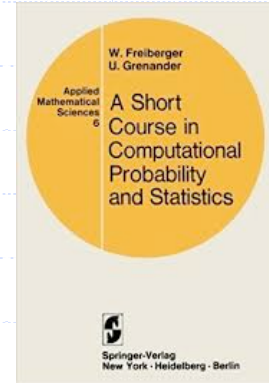
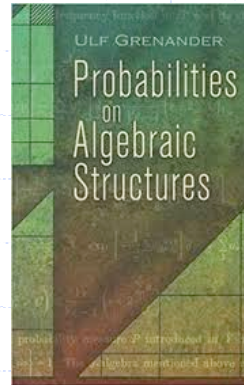
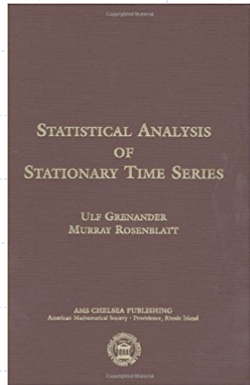
PERSONAL COLLABORATIONS

- Automated target recognition: Jump-Diffusion Processes on Lie Groups (1996)
- Bounds on estimators taking values in Lie groups (1998)
- Laplace Approximation on Groups: Bayes error rates (2001)
- Bessel K Forms: Natural image statistics (2001)
- GRID Model (2005)
- “Discretize as late as possible”





PRODUCTIVITY: BOOKS





FINAL WORDS

- Quite simply the finest man I have ever met.
- Michael Miller: “I miss Ulf”.