

## The Software Crisis Reconsidered

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Grenoble SOFT-EU Workshop

## Structure

1. Prominence of SW Crisis & 1968 NATO Meeting in Secondary Literature
2. Lack of corresponding prominence in practitioner accounts
  - “Software Crisis” didn’t stick
3. Why?
  - Initial analysis & speculation
4. So?
  - Implications for project

## 1: Prominence in Existing Literature

## High Profile of SW Crisis & NATO Conference in Secondary Literature

- Friedman 1989, *Computer Systems Development* – ch5. 6 pages on NATO conf, 3 on SW crisis in business
- Series of papers by Mahoney on Software Engineering (1990, 2004) -- ACM SIGSOFT project
- Campbell-Kelly & Aspray, *Computer*
  - 5 pages on OS/360
  - 3 pages on Software Engineering (incl NATO conf)
- Ceruzzi, *History of Modern Computing*
  - 1 page on Software Engineering (incl NATO conf)
  - Also 1 page on structured programming
- McKenzie – Mechanizing Proof
  - Lengthy history of formal methods

## Dominated “Agenda Setting” Conference for Software

- Five main articles
- Three are framed by SW Eng. & NATO Conference
  - McKenzie, SW as Reliable Artifact
  - Ensmenger & Aspray, SW as Labor Process
  - Tomayko – SW as Engineering
- Another discusses SW Engineering
  - Mahoney, SW as Science, Science as SW
- Amazon shows
  - 26 pages with SW Crisis
  - 106 pages with SW Engineering



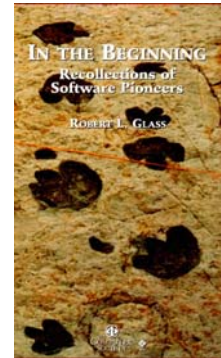
## Prominence in Dissertations

- SW Crisis and/or SW Eng is main theme/framing concept in
  - Valdez, Maria Eloina Pelaez. "A Gift From Pandora's Box: The Software Crisis." Ph.D., University of Edinburgh, 1988.
  - Shapiro, Stuart S. "Computer Software as Technology: an Examination of Technological Development." Carnegie-Mellon, 1990.
  - Ensmenger, Nathan. "From Black Art to Industrial Discipline: The Software Crisis and the Management of Programmers." Ph.D., University of Pennsylvania, 2001.
- Possibly the only three dissertations over this period on the *history of software* (as opposed to specific applications/systems)

## 2: Lack of Prominence Elsewhere

## Glass Collection of Memoirs

- No mention of NATO conference or SW Crisis
- Authors include
  - Watts S. Humphrey
  - Barry Boehm
  - Peter J. Denning
- No entries in index for
  - NATO Conference
  - Software Crisis

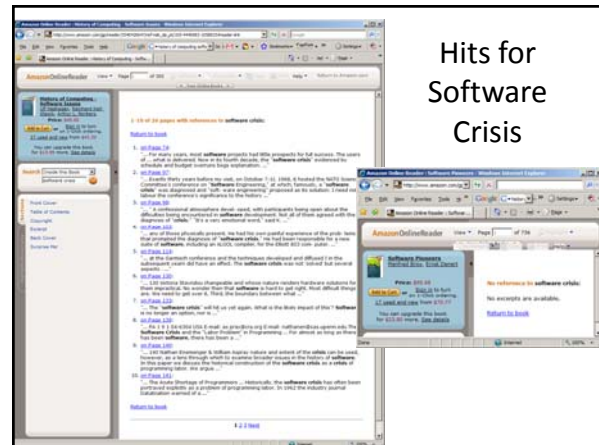


## Software Pioneers, ed. Broy & Denert

- Seminal paper and modern reflections from each pioneer
- 1968 Nato Conf gets one in text reference (Dijkstra) and two citations (Boehm 2001 paper, Parnas 1972 paper) in 750 pages
  - More cites for NATO Summer School on Programming Languages.
  - Algol referenced on 64 pages
- Authors NOT mentioning or citing include
  - Tom DeMarco
  - Michael Jackson
  - Peter Chen
  - Michael Fagan
  - CAR Hoare
  - Bauer??



## Hits for Software Crisis



## Marginality in DP Literature

- Huge literature for DP Managers & staff
  - Datamation, Business Automation, EDP Analyzer
  - Harvard Business Review & similar journals
  - Consulting reports
- Approximately nothing in 1960s on SW Crisis/Engineering
- A few articles from 1973 onward
- Gradual appearance of specific topics
  - Structured Programming
  - Analysis & project management methodologies
  - Costing & estimation techniques

## Mutual Ignorance

- Dijkstra, EWD 611:
  - (1) good programming is probably beyond the intellectual abilities of today's 'average programmer'
  - (2) to do, hic et nunc, the job well enough with today's army of practitioners, many of whom have been lured into a profession well beyond their intellectual abilities, is an insoluble problem
  - (3) our only hope is that, by revealing the intellectual contents of programming, we will make the subject attractive to the type of students it deserves, so that a next generation of better qualified programmers may gradually replace the current one.
- Infosystems article 1975 ("Structured Programming is Not a Fad):
  - few data processing managers today even know of Dijkstra.

### Example: Management Information Systems

- Similar to today's ERP systems
  - Huge topic in managerial computing literature from 1959 to 1968
  - Loss of faith circa 1968 after many failures
  - Entirely separate discourse, communities from software crisis & software engineering
- Different solutions during 1970s
  - Lower ambition
  - Used packaged applications (SAP)
  - Data Base Management Systems & Transaction Processing Middleware
- See Haigh 2001, "Inventing Information Systems..."



### 3: Why? Preliminary Thoughts

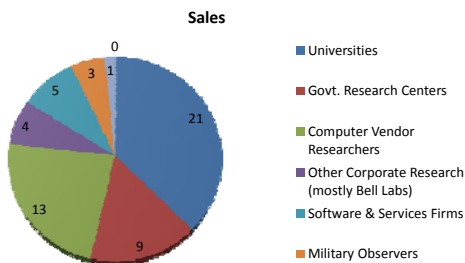
### Why Do We Love Garmisch?

- Distinct, well-known event
- Popularized term "Software Engineering"
  - Is sometimes referenced in SW Eng. literature
- Partial transcript available
  - Full of good sound bites
  - Rhetorical continuities with later SW Engineering claims
- Resonates with issues in history of science & technology literature
  - Taylorism (the "Software Factory")
  - Claims to cultural authority of engineering
  - Diverging identities of craft, science & engineering
- "Software Crisis" sounds compelling
  - As Mike says, historians are trained to look for them.
- Self-reinforcing prominence in secondary literature.
  - Obligatory point of passage
  - Like ENIAC in Mike's "Histories of Computings" chart

### What Was "Software" Anyway

- Software <> Programs in this era
  - See Haigh, 2002 & Mahoney in Paderborn volume, p.43
- Meaning unstable in 1960s
  - Begins as complement to hardware – everything else supplied by computer vendors
  - Sometimes used as description for services and consulting industry
  - Much more commonly applied to systems programs than ordinary applications
- Therefore
  - History of software <> history of applications
  - Software crisis <> programming crisis

### Breakdown of Attendees to 1968 NATO Software Engineering Conference



### Who Wasn't There?

- Anyone from end user firm
  - Banks, Insurance, Manufacturing, etc.
- Data Processing managers
- Computing experts in business schools
  - Or anyone involved with "MIS" integrated systems
- Administrative or scientific programmers
- Business systems analysts or "Systems Men"
- DBMS software specialists
- Packaged software firms
  - (almost an anachronism)

## What SW Did They Care About?

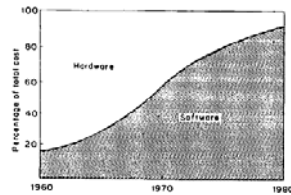
- Operating Systems
  - MAC CTSS
  - Multics
  - OS/360 (as much as everything else put together)
  - TSS/360 (becomes TSO?)
  - ECS Scope (CDC)
  - Experimental – Dijkstra, SODAS by Parnas & Darringer, Zucher & Randall IBM Watson lab
- Compilers
  - PL/I
  - AED (Algol-based MIT string oriented language)
  - FORTRAN Compilers
  - Nebula compiler for ICT Orion
  - IPL and LISP (Perlis)
- Real-time control systems
  - “Electronic Switching Systems” at Bell
  - TSS/635 (OS for military online system)
  - SABRE
- Also discussion of tools to SUPPORT system development
  - Autoflow, Com Chart, Mercury, TOOL, etc.

## What Was the Crisis?

- Problems with complex interactive systems software
  - Multics, Computer utilities & timesharing
  - OS/360
  - Military control systems?
- Problems with compilers
- Most programming dismissed in passing
  - “Of course 99 percent of computers work tolerably satisfactorily; that is the obvious. There are thousands of respectable Fortran-oriented installations using many different machines and lots of good data processing applications running quite steadily; we all know that!”
  - Prof J.N. Buxton – University of Warwick, 1968 NATO Conf

## Manufacture-centric Viewpoint?

- Influential prediction from Boehm 1973
  - Claims to represent air force experience
- But in user organization programming was always a huge cost
- Is real perspective that of computer vendors?
  - Unbundling as partial solution



## Main Points So Far

- “Software Crisis” concept has no resonance with historical actors
- NATO Conference involved very limited selection of
  - Kinds of software
  - Kinds of people
- Even the people involved in spreading SW system development methodologies in 1970s make little reference to NATO conference

4: So?

## Software Engineering as Identity

- Appeal almost exclusively within research environment
  - Reaction against establishment of core computer science identity in late 1960s
    - Theoretical, mathematical/logical
  - Creates legitimate areas of research around creation of complex software systems
- Programmers, analysts & managers do not widely adopt it
  - Possible exception for firms where engineering identities are high status/mainstream
    - engineering firms like Boeing
    - computer designing firms

### Software Crisis

- Actor's category
  - Should be treated with great care by historians
  - Reflects very specific constructions and assumptions
- Yet, a concept that has had far more resonance with historians than historical actors!

### Relevance to This Project

- Algol
  - Algol's influence greater than NATO Conference
  - Pioneer stories show more practice-based, gradual emergence of "SW Engineering" techniques
  - Language implementation problem WAS solved by reusable tools (Lex & Yacc) & better theoretical models/techniques
- IBM in Europe
  - Role of IBM people & stories in NATO conference
  - Formal methods in IBM Vienna Lab
  - Role in devising/spreading programming practices

### Alternative Summary

**"Software crisis"  
considered harmful.**