Software Evolution, its Nature and Control - Plans for Further Work after FEAST

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The 'What' & 'Why' of Evolution - FEAST Results

- **Evolution characteristics** and **behavioural patterns** of released-based systems observed in the 90s, similar to those studied in the 70s
- **Support**, after minor modifications, for 7 of the 8 **laws of software evolution**
- New **insights** into and **conclusions** about the process and about its feedback system nature
- Black box and system dynamics **models** to support **process planning**, **management**, **improvement**, **tuning**
- Some 35 **management** and **planning** rules and guidelines

Further investigations being proposed

Two proposed investigations

- With completion of FEAST/1 and /2

EPiCS - Empirical Phenomenology in Component-intensive Software

SETh - Towards a Theory of Software Evolution

Some highlights...

Trend to Component-intensive Software

- A **widespread** view is that the way forward in software development and acquisition is through the **use of components**, as exemplified by COTS
- Not new - discussed at Garmisch conference 68

But unanswered questions in context of evolution phenomenon

Components of E-type Host Systems also Evolve

- ***E*-type** components
  - **solve** a **problem** or address an application in a **real-world domain**
  - **stakeholders' satisfaction**, primary criterion of success
  - as for *E*-type systems, need for **continuing evolution**, **inescapable**

- ***S*-type** components
  - **satisfaction** of an **specification**, primary criterion of success
  - "**bricks**" from which systems are built
  - **acquire** *E*-type characteristics when **integrated**, since it requires assumptions about properties of other components

- Thus, **all** components of *E*-type host systems are subject to evolutionary pressure

- Achieving **evolution by "glueware",** - e.g., component wrapping - diminishes need for component evolution, by **reverting** to **traditional practice**

The Plan

- Assessment of **long-term effectiveness** of component-orientation
- Laws and other FEAST, and related, results as **hypotheses** for empirical investigation
- Study both **quantitative** and **non-quantitative** data
- Investigation will face technical **challenges** - scarcity of data, probably stronger role of individuals in smaller integration teams, increase number of agents, and so on
- Our WESS position paper describes plans for the EPiCS empirical investigation

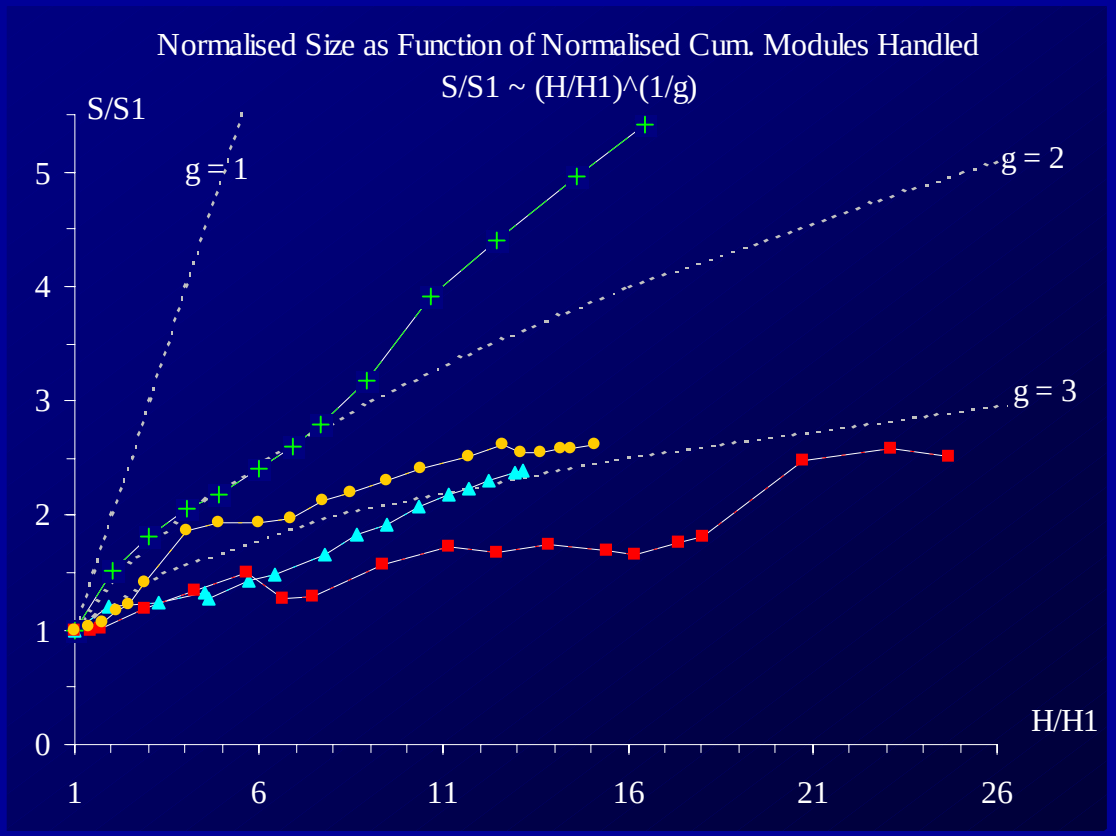
In general, if funded, **EPiCS** project will investigate **system evolution** under component-intensive paradigm

Why a Theory?

- Theory provides **basis** and **framework** for unifying, verifying, extending an engineering technology
- **Need** for a software theory already identified at Garmisch 68
- **Existing** theory addresses **programming methodology**, not industrial **process**
- Software **process improvement** ***ad hoc***, individually conceived, based primarily on **experience**, **intuition**
- Theory seeks, in general, to establish **links** between **descriptions** of facts and **prescription** - when achieved, offers basis for **justification** of ***good practice***

If funded, **SETh** will seek and develop foundations of a theory

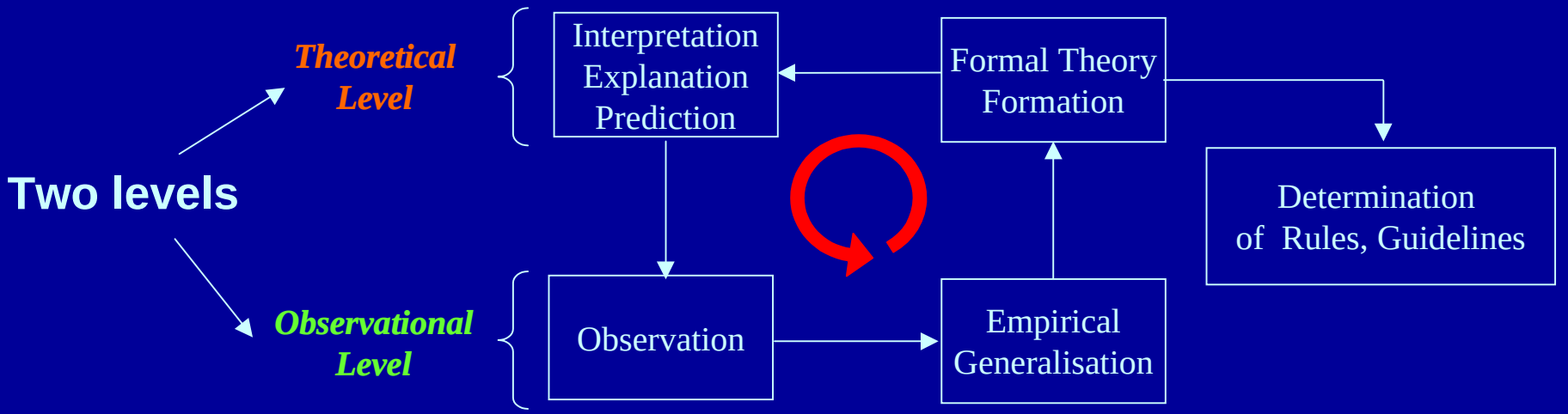
Candidate for Empirical Generalisation



- Growth models discussed in ICSM 2001 paper
- One system starts following $S = E^{1/2}$ trajectory, though mid-life change requires further analysis
- Note closeness in 3 of the systems to "$S = E^{1/3}$ trajectory"

The Plan

- Two-level approach to theory formation



Final Remarks

- FEAST was an attempt to apply **scientific method** to issues usually regarded as not amenable to systematic study
- Its success and the results produced have identified a need for further investigation - hence the two pronged SETh and EPiCS proposals
- In particular, FEAST has provided ***empirical generalisations*** that are essential for development and assessment of candidates theories and for reasoning about the challenges arising from the use of components
- Go-ahead depends on funding decision
- Others groups invited to take up approach
- In particular, we welcome comments from WESS participants with regards to these views and plans

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