Researching the Institutional Structure of Technological Innovation: Working with IP Data

-

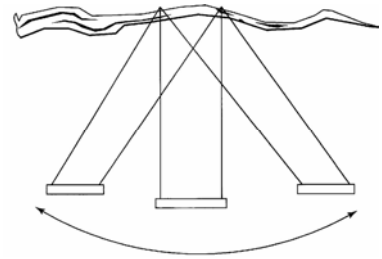
Wednesday Workshop

ESNIE 2006
Cargèse, Corsica
17 May 2006

The Structure of our Session

Motivation: *Controversies*	5 minutes
Overview of IP Data: Sources and Uses	20 minutes
Questions	15 minutes
Applications in Researching the Institutional Structure of Innovation	20 minutes
Questions	15 minutes
Discussions - Questions	15 minutes

Remember this drawing?



A Broken Patent System?

(12) **United States Patent**
Olson

(10) **Patent No.: US 6,368,227 B1**
(45) **Date of Patent: Apr. 9, 2002**

(54) **METHOD OF SWINGING ON A SWING**

(76) Inventor: **Steven Olson**, 337 Otis Ave., St. Paul, MN (US) 55104

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/715,198**

(22) Filed: **Nov. 17, 2000**

(51) **Int. Cl.**[7] **A63G 9/00**
(52) **U.S. Cl.** **472/118**
(58) **Field of Search** 472/118, 119, 472/120, 121, 122, 123, 125

(56) **References Cited**
U.S. PATENT DOCUMENTS

242,601 A * 6/1881 Clement 472/118
5,413,298 A * 5/1995 Provault 246/228

* cited by examiner

Primary Examiner—Kien T. Nguyen
(74) *Attorney, Agent, or Firm*—Peter Lowell Olson

(57) **ABSTRACT**

A method of swing on a swing is disclosed, in which a user positioned on a standard swing suspended by two chains from a substantially horizontal tree branch induces side to side motion by pulling alternately on one chain and then the other.

4 Claims, 3 Drawing Sheets

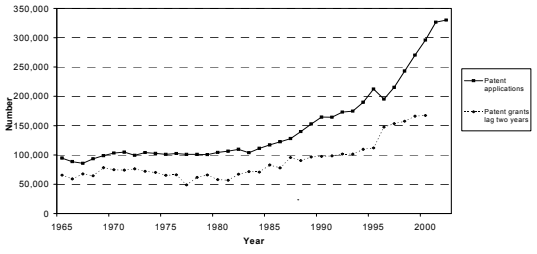
- Lastly, it should be noted that because pulling alternately on one chain and then the other resembles in some measure the movements one would use to swing from vines in a dense jungle forest, the swinging method of the present invention may be referred to by the present inventor and his sister as "Tarzan" swinging. The user may even choose to produce a Tarzan-type yell while swinging in the manner described, which more accurately replicates swinging on vines in a dense jungle forest. Actual jungle forestry is not required.

Licenses are available from the inventor upon request.

Jaffe & Lerner: Innovation and its Discontents

- Patent Regime reconfigured
  - 1982: Founding of the CAFC
  - Early 90s: USPTO Fee structure changed
- Resulting parade of horribles
  - Patents on inventions that are trivially obvious
  - Strong patents are potent strategic weapons, e.g. semiconductors
  - Huge court awards tax competitors
  - Knowledge is slow to reach examiners, esp. in new technologies

Figure 1
USPTO Utility Patents 1965-2002



Why patents? *Economic Rationale*

- Societal costs (Welfare Loss) of Patent System
  - Deadweight loss from patent "monopoly"
  - Transaction costs
- Greater benefits to society (Welfare Gains)
  - Create incentives for invention
  - Require disclosure of invention to public
    - Knowledge spillovers may enable follow-on innovation
  - Create incentives for *commercialization* of invention by inventor, or others
  - Support markets for Intellectual Property
    - May enable vertical specialization in industries

Forces eroding Welfare Gains

- Low "Quality"
  - Lacking requisite novelty, non-obviousness, utility
- Uncertainty
  - Over final *boundaries* of the disclosure
  - Over the *validity* of the property right
    - Under- or misdirected investments
      - by inventor in the patented technology
      - by competitors in competing technologies
    - Adds transaction costs to commercialization, technology transfer (licensing), developing markets for IP
    - Conferring market power to trivial innovations with little or no social welfare
    - Create an environment inviting to costly litigation

Posture: Policy demand for Reform

- Academy
  - Science, Technology and Economic Policy Board (STEP) of the National Academies
    - Committee on IPRs
    - October 2002 meetings
- US Government Agencies
  - USPTO "Strategic Plan for the 21st Century" (2002)
  - FTC "To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy" (2003)
- Interest groups
  - AIPLA (2004), IBM, other large firms, BSA
- US Congress
  - HR 2795 (2005); Rep's Berman (D-Ca) & L. Smith (R-Tx)

IP-data based research: current knowledge

My "main thrust"...

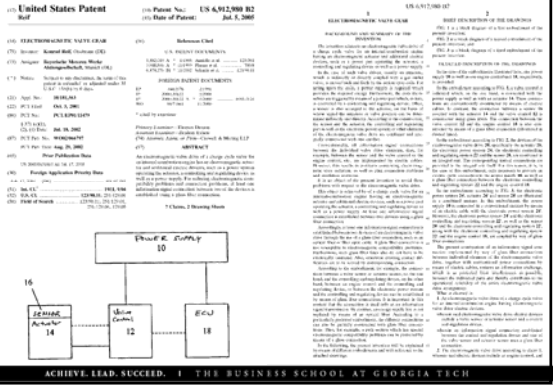
Questions for this part of the presentation

- **What types of IP information are available?**
- **How have these data been used to study the institutions of innovation?**
- **Where may I obtain IP data?**
- **What are some opportunities, and challenges, in using IP data?**

Main "Species" of IP Protection: What's in them, and how can it help me as a researcher?

- Patent
  - Government-granted right to prevent others from using a stated technology
    - Administrative process, with substantial applicant input
    - Limited in time, scope
    - monopoly? Sort of, but not *really*...
- Copyright
  - Government-granted, and "natural" right protecting authors, creators
    - Limited? in time, limited to "expression"
- Trademark
  - Government-granted protection for brand marks, "consumer protection"
    - Limited in subject matter, unlimited in time—but actively protect, maintain
- Secret
  - Protection?
    - In the US: valuable information, reasonable efforts, unlimited in time—but independent discovery
  - Observable?

Observable information: what does it look like?



Observable information: IP data

First, some things that are *not* in the data

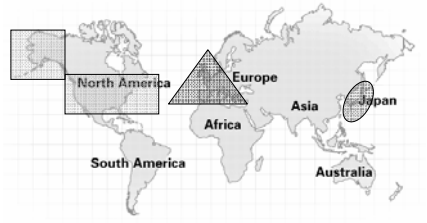
What's not observable?
- No information on products
- No performance data *per se*
- No sales data

Why not?
- Purpose of disclosure requirements: dissemination of technical and legal knowledge, not necessary economically relevant knowledge

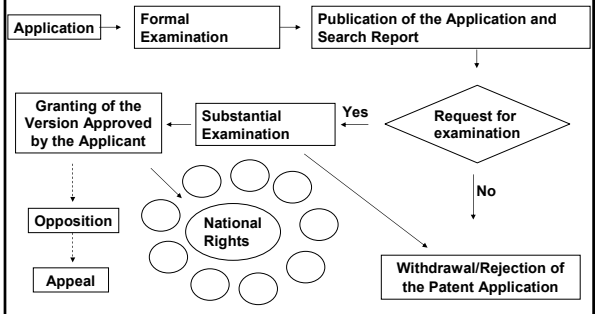
What's observable then?
- A bunch of information on applicants, inventors, legal terms, technology
- What information exactly? Depends on geography. I will focus primarily on European and US patent data

Observable information: the territories

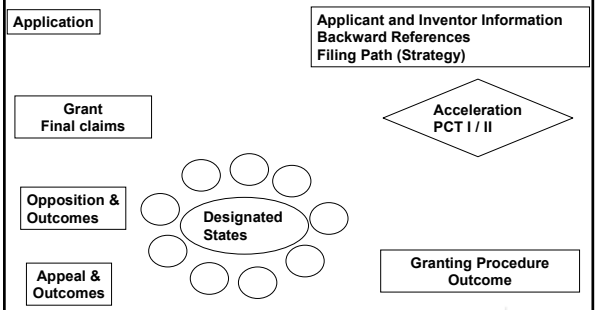
United States: US PTO | **Europe: EPC-EPO** | **Japan: JPO**



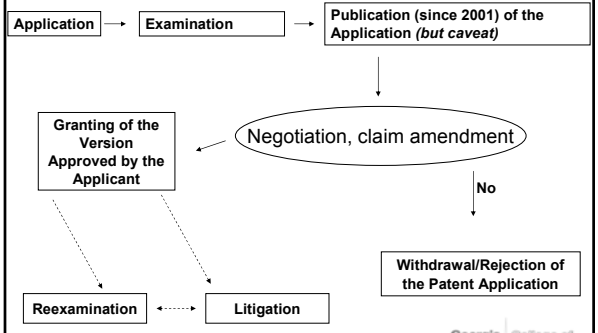
Observable information: the EP granting procedure



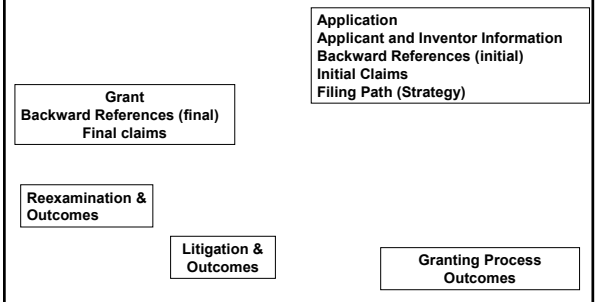
Observable information: the EP granting procedure



Observable information: US granting procedure



Observable information: US granting procedure



Observable information: a list of data

Relevant information for management scholars

Immediately observable
- Applicant data
- Inventor data
- Technology classes
- Backward references
- Familiy size
- Filing routes (patenting "strategy")
- Litigation

Computable
- Forward citations (time lag)
- Originality
- Generality (time lag)

Interpretating information

Equivalents or "Family" Information

Contains:
- Designated countries (incl. country code)

Has been applied to the study of:
- Innovation
- Valuation of IP
- Institutional Economics

Some references:
- Lanjouw/Pakes/Putnam (1996); Graham/Hall/Harhoff/Mowery (2003); Graham/Harhoff (2006); Jensen/Palangkaraya/Webster (2006).

Interpretating information

Timing – Application Dates, Continuations, PCT

Contains:
- Information on the timing of "initial spark," strategic choices during application process

Has been applied to the study of:
- Valuation of IP
- Competition analysis
- Firm Strategy

Some references:
- Quillen/Webster (2003); Graham/Mowery (2004); Reitzig (2004); Graham/Harhoff (2006); Jensen/Palangkaraya/Webster (2006).

Interpretating information

Post-grant Reviews (e.g., litigation, opposition, etc.)

Contains:
- Information on type of suit challenges (validity or infringement), names of parties, outcomes

Has been applied to the study of:
- Valuation of IP
- Competition Analysis
- Institutional Economics

Some references:
- Lerner (1995); Lanjouw/Schankerman (2001); Harhoff/Scherer/Vopel (2003); Somaya (2003); Graham/Hall/Harhoff/Mowery (2003); Harhoff/Reizig (2004); Lanjouw/Lerner (2004); Graham/Harhoff (2006)

Interpretating information

Forward Citations

Contains:
- Information on how often/by whom a patent is referenced as relevant prior art during subsequent patent examination processes

Has been applied to the study of:
- Valuation of IP
- Social network theory
- Technological pathways
- Knowledge flows

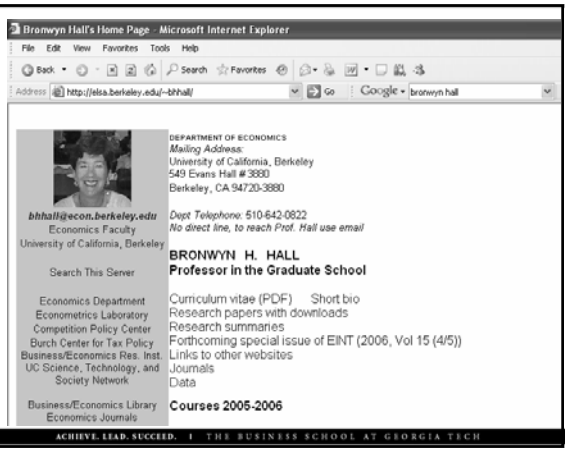
Some references:
Trajtenberg (1990); Trajtenberg/Jaffe/Henderson (1997); Stuart (1998); Mowery/A.Ziedonis (2001); Alcacer/Gittleman (2003); Hall/Jaffe/Trajtenberg (2005)

Interpreting information

Research areas previously explored using patent data:

Competition analysis
Firm Strategy
Innovation
Institutional Economics
Knowledge flows
Social network theory
Strategic alliances
Valuation of intangible resources

And in the future? ...



Collecting information

Data sources

***"Free but raw,"* offical registers, designed for case-based research. No computed indicators**

- **EPOLINE**
- **USPTO**

"Free, not raw, but used"

- **NBER (Hall, Jaffe, and Trajtenberg, 2000)**
  - **US patent data complete 1975-1999 (with some data 1963-2002)**
  - **Standard indicators (incl. forward cites) computed**
- **NSF (Cockburn, et al., 2005)**
  - **Multi-year update of the NBER data, with link-outs**

Commercial providers

- **Micropatent**
- **Derwent**

Using information

Opportunities and Challenges??

- **The costs to using data have (and continue to) fall**
  - **NBER/NSF database;**
  - **Computing power**
- **Uncertain rewards to using the current data**
  - **Does the use of data become expected, or passé?**
- **Likely rewards at the frontier**
  - **New applications, employing greater institutional knowledge (and methodological skills)**
- **Other Data**
  - **Copyright**
  - **Trademark**
  - **Secrecy?**

Application I: "Post-Grant Reviews"

Economic criticisms: US Litigation

- Costly: Estimates $0.5-4M per suit; $500K per claim
  - some as high as $20M in biotech, $48M for Polaroid.
- Prolonged: Estimated 31 months for trial
- Burdensome: May not serve "quality" concerns
  - Patent afforded a presumption of validity; "born valid"
  - Generally, patentee holds the litigation "trigger"
  - Burden of proof set high: "clear and convincing" standard
  - Judge and/or jury may have limited expertise
- Escalation: Increasing rates, and sheer numbers
  - Estimates changed little from 1970s to early 1990s: 1-2%
  - Rate rose in late 1990s; current research 1998-2000: 3%
  - As number of issued patents explodes => litigation explodes

Administrative Alternatives to Litigation: US, EU (EPC)

- United States patent challenges
  - Reexamination post-issue (during the life of the patent)
    - *Ex parte, inter partes*
- EU (EPO) patent challenges
  - Opposition post-issue (within 9 mos.)
  - Litigation for validity or infringement *in national courts*

EPO Opposition: Distinctions

- Administrative, non-judicial process
  - Examiners (technical experts) hear challenge
  - Administrative judges on appeal
- Adversarial proceeding initiated by any third party
  - *de novo* hearing
- Validity questions (not infringement):
  - Patent may be challenged on grounds of patentability
    - Subject matter, inadequate disclosure, scope of grant larger than original application
- Much lower cost than litigation, cost (€ 20-30K)
  - In operation, 8% of patents are opposed
  - 1/3 of these are revoked outright, with a further 1/3 partially revoked.
- *But*… Time limit - 9 months of patent grant
- *But*… Outcomes are generated slowly (average 1.9 years)

Tab. 4: Results - EP applications

Table 4
Descriptive Statistics for EPO Equivalent Applications of Litigated and Non-Litigated USPTO Patents – Paired and Unpaired Comparisons

	Test (1) vs. (4)	Test (2) vs. (3)	(1) EPO equivalents of litigated US patents	(2) EPO equivalents of litigated US patents	(3) EPO equivalents of non-litigated US patents	(4) EPO equivalents of non-litigated US patents
			no EPO equivalent for matching unlitigated US patent	EPO equivalent for matched pairs of litigated and non-litigated US patent		no EPO equivalent for matching litigated US patent
equivalent EPO applications (US patents)	-	-	2,474 (2,419)	943 (923)	943 (923)	2,393 (2,372)
examination outcomes	-	-				
• application pending	-	-	9.5	4.8	4.7	8.6
• grant	-	-	68.9	80.3	67.9	59.9
• application withdrawn or consolidated	-	-	18.7	11.7	22.6	27.5
• grant effectively refused by EPO	-	-	3.0	3.3	4.8	4.1
number of claims in application*	< 0.01	< 0.01	18.32 (0.29)	16.48 (0.46)	13.67 (0.33)	15.61 (0.24)
number of references to other patents*	< 0.01	< 0.01	5.21 (0.07)	4.65 (0.10)	4.26 (0.09)	4.49 (0.06)
share of X references*	0.24	0.50	17.62 (0.54)	16.61 (0.86)	15.77 (0.90)	16.72 (0.54)
share of Y references*	0.02	0.52	15.26 (0.52)	13.45 (0.78)	14.74 (0.79)	13.62 (0.51)
EPO citations received within 5 yrs*	< 0.01	< 0.01	4.18 (0.11)	5.46 (0.22)	2.64 (0.11)	2.36 (0.07)
share of X citations received within 5 yrs*	0.17	< 0.01	8.79 (0.44)	8.13 (0.57)	5.51 (0.53)	7.98 (0.44)
share of Y citations received within 5 yrs*	0.07	< 0.11	6.59 (0.35)	6.17 (0.49)	5.02 (0.54)	5.70 (0.36)

Source: Authors' computations from ESPACE and EPOLINE data. Data on the number of claims was supplied by the EPO from its internal EPASYS database.
* Mean value, standard errors in parentheses.

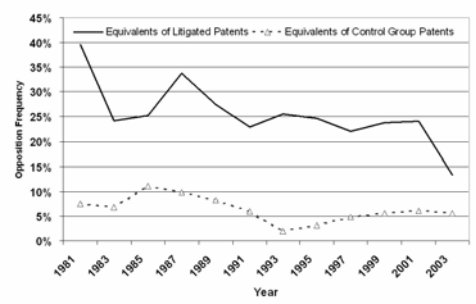
Tab. 5: Results - Oppositions

Table 5
Descriptive Statistics for EPO Equivalent Patent Grants of Litigated and Non-Litigated USPTO Patents – Paired and Unpaired Comparisons

	(1) EPO equivalents of litigated US patents	(2) EPO equivalents of litigated US patents	(3) EPO equivalents of non-litigated US patents	(4) EPO equivalents of non-litigated US patents
	no EPO equivalent for matching unlitigated US patent	EPO equivalent for matched pairs of litigated and non-litigated US patent		no EPO equivalent for matching litigated US patent
equivalent EPO patent grants (US patents)	1,923 (1,873)	564 (548)	564 (548)	1,515 (1,497)
time to grant (years)	4.11 (0.05)	3.56 (0.08)	3.42 (0.08)	3.73 (0.05)
opposition rate	18.6	24.2	7.5	5.2
opposition pending	25.1	14.8	9.5	25.6
opposition outcomes (non-pending cases)				
• patent revoked	22.6	24.4	39.5	27.6
• opposition rejected	24.8	24.4	23.7	34.5
• patent amended	38.0	38.3	34.2	29.3
• opposition closed	14.7	13.0	2.6	8.6
opposition outcomes (consolidated)				
• patent revoked or lapsed	32.3	34.8	39.5	32.8
• opposition rejected or withdrawn	29.7	27.0	26.3	37.9
• patent amended	38.0	38.3	34.2	29.3
appeal rate	50.7	55.6	42.9	26.9

Source: Authors' computations from ESPACE and EPOLINE data. Data on the number of claims was supplied by the EPO from its internal EPASYS database.
* Mean value, standard errors in parentheses.

Fig. 5: Opposition Frequency



Welfare Analysis

- Cost-benefit analysis
- We use evidence to inform us: costs, rates
  - Litigation rates 1.1% - 3.2%
  - Opposition rates
    - equivalents of non-litigated US patents 6%
    - equivalents of litigated US patents 20%
  - Outcomes: revocation about 1/3, amendment about 1/3
  - Outcomes: benefits
    - avoided litigation costs $4m (AIPLA)
    - reduced (erroneously granted) market power ($1-$4m)
  - Appeal rates
    - 52% for equivalents of litigated US patents
    - 32.5% for equivalents of non-litigated US patents

Welfare Calculations

(1.1) *Saved litigation expenses*

$$W_1 = p_L \cdot P \cdot p_{O,L} \cdot (p_{R,L} + 0.5 p_{PR,L}) \cdot S_L$$

(1.2) *Removing excess market power*

$$W_2 = (1 - p_L) \cdot P \cdot p_{O,NL} \cdot (p_{R,NL} + 0.5 p_{PR,NL}) \cdot S_{NL}$$

(1.3) *Costs of post-grant review*

$$C = p_L \cdot P \cdot p_{O,L} \cdot (C_O + (p_{A,L} \cdot C_A)) + (1 - p_L) \cdot P \cdot p_{O,NL} \cdot (C_O + (p_{A,NL} \cdot C_A)$$

Tab: 8: Estimates

Table 8
Welfare Calculations

	Parameter	Scenarios							
		1	2	3	4	5	6	7	8
	Current System Parameters								
δ_S	social cost of litigation	$4	$4	$4	$4	$2	$2	$2	$2
δ_{SR}	social cost of non-litigated revocable patent	$4	$4	$1	$1	$1	$1	$1	$1
p_L	probability of litigation without post-grant system	0.032	0.011	0.032	0.011	0.032	0.011	0.032	0.011
	GH Estimates (Table 4, weighted averages)								
p_{OLI}	probability of opposition - litigated patents	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198
p_{ONR}	Probability of opposition - non-litigated patents	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
p_{RL}	probability of revocation - litigated patents	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354
p_{RNR}	probability of revocation - non-litigated patents	0.330	0.330	0.330	0.330	0.330	0.330	0.330	0.330
p_{PRL}	probability of partial revocation - litigated patents	0.313	0.313	0.313	0.313	0.313	0.313	0.313	0.313
p_{PRNR}	probability of partial revocation – non-litigated patents	0.381	0.381	0.381	0.381	0.381	0.381	0.381	0.381
p_{AL}	probability of appeal – litigated patents	0.520	0.520	0.520	0.520	0.520	0.520	0.520	0.520
p_{ANR}	probability of appeal – non-litigated patents	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
	Opposition Cost Estimates								
C_O	cost of opposition	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.20
C_A	cost of appeal against opposition outcome	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.20
	Welfare and Total Cost Estimates								
W_1	welfare gain from avoided litigation	2,588	889	2,588	889	1,294	443	1,294	443
W_2	welfare gain from revocation of questionable patents without litigation	23,378	23,886	5,845	5,971	5,845	5,971	5,845	5,971
C_L	cost of opposition – litigated patents	96	33	96	33	96	33	193	66
C_{NR}	cost of opposition - non-litigated patents	744	760	744	760	744	760	1,488	1,520
W_{NET}	total net benefit	25,126	23,912	7,592	6,068	6,298	5,623	5,458	4,830
BC_{OVRL}	overall benefit-cost ratio	30.9	31.2	10.0	8.7	8.5	8.1	4.2	4.0

Note: all cost and benefit figures in million US$

Conclusions

- US litigation system is costly and burdensome to challengers – those with incentives, information
- EPO examination does not disproportionately exclude patents whose US equivalents were litigated.
- Opposition rates for equivalents to litigated patents substantially higher
- We find that the welfare gains from an opposition system may be substantial
- The main source of these welfare gains is *not* foregone litigation, but elimination of excess market power.
- *Caveat:* Any benefits will likely be eroded with increasing cost of opposition.

Application II: US Continuation Patents

Federal Circuit Bar Journal, Vol. 11, No. 1 (August, 2001), pages 1-21

CONTINUING PATENT APPLICATIONS AND PERFORMANCE OF THE U.S. PATENT OFFICE

Cecil D. Quillen, Jr. and Ogden H. Webster

US Patent Continuation practice

- 2 Truisms
  - The patent office is unable to ever finally *refuse* to grant a patent
  - The patent office is unable to ever finally *grant* a patent
- The culprit?
- The continuation application

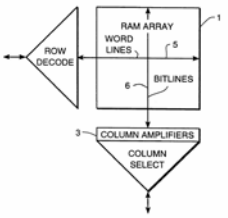
ABSTRACT

The United States is unique in permitting patent applicants to refile their patent applications as continuation and continuation-in-part applications claiming the benefit of the filing date of a prior application and restart the examination process all over again. Data provided by the USPTO concerning continuing application filings for its fiscal years 1993-1998 reveal that 28.4% of the utility, plant, and reissue (UPR) applications filed in those years were not new or original applications, but were continuing applications claiming the benefit of the filing dates of previously filed applications. Analysis of the data for continuing applications for the USPTO's fiscal years 1993-1998 in conjunction with the USPTO Annual Report statistics for the same fiscal years shows that the number of UPR applications allowed in fiscal years 1995-1998 was 95% of the number of original UPR applications filed in fiscal years 1993-1996. Comparable Allowance Percentages for the European and Japanese Patent Offices were calculated to be 68% and 65%, respectively. A study of the cohort of German patent applications claiming a 1977 priority date had found that only 41.7% of the 1977 German applications became patents. The Grant Rate (allowances divided by total disposals, i.e., the sum of allowances and abandonments) for the USPTO for its fiscal years 1993-1998, corrected for continuing applications, ranges from 87% to 97%, depending on the extent to which prosecution of abandoned applications was continued in refiled applications. Reported Grant Rates for 1995-1999 for the European and Japanese Patent Offices (averaged) are 67% and 64%, respectively. Policy questions resulting from the lack of rigor by the USPTO in its examination of patent applications are discussed.

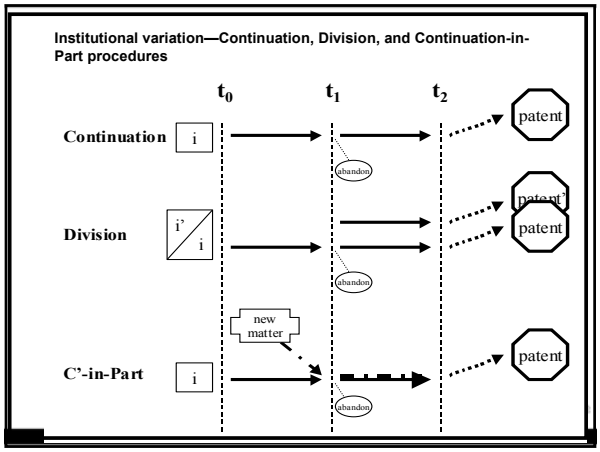
Rambus, Incorporated: *"An Intellectual Property Company"*

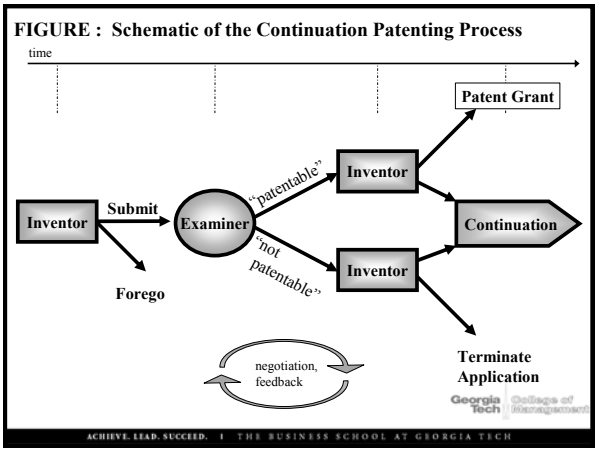
U.S. Patent Sep. 21, 1999 Sheet 1 of 16 **5,954,804**

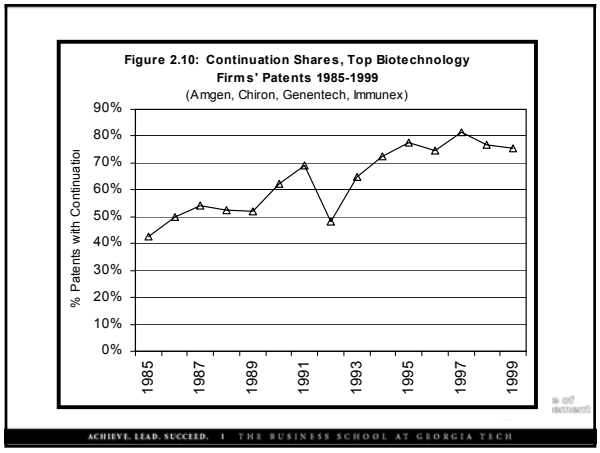
FIG_1

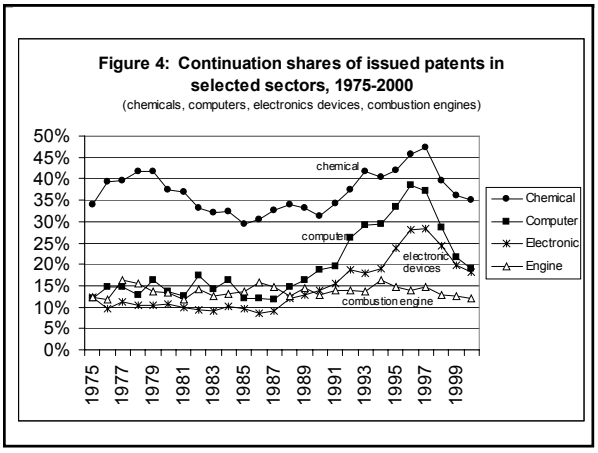


❖This application is a divisional of application Ser. No. 08/710574, filed Sep. 19, 1996, now abandoned,
❖which is a continuation of application Ser. No. 08/469,490 filed Jun. 6, 1995, now abandoned,
❖which is a continuation of application Ser. No. 07/847,961 filed Mar. 5, 1992, now abandoned,
❖ which is a divisional of application Ser. No. 07/510,898 filed Apr. 18, 1990 now abandoned.









Supplemental: U.S. Regime Changes: 1995, 1999

- Continuation priority was arguably more valuable pre-1995
  - Patent term 17 years measured from date of *issue*
- Uruguay Round GATT, effective June 1995
  - Int'l harmonization; reduce incentives for "continuation"
  - Patent term now 20 years from date of *application*
  - Filings after June '95, maximum 20 years to both prosecute and protect an invention
  - Forces a choice, *ex ante* secrecy versus *ex post* protection
- 1999 Inventors' Protection Act
  - Publication of most applications after 18 months
  - **Excepted:** special class of US-only inventions

Conclusions

- Opportunities abound for productive research in this area
- Changing research environment
  - While the costs to using these data have fallen dramatically…
  - the rewards to understanding, *and being able to productively analyze*, the institutional details has increased