
Identification of Creative Research Accomplishments. Methodology and Results for Nano S&T and Human Genetics

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Motivation for CREA study

1. Science-based technology fields build strongly on functioning (public) research base
2. Institutional change in the last two decades: higher legitimacy for applied research
3. Traditional funding sources tend to exclude unconventional, risky and out-of-the-box research
4. Organisation of research has changed in many nation states

Presentation

1. Motivation
2. Prior research
3. Overview CREA study
4. Typology of creative research accomplishments
5. Identification of creative scientists and groups
6. Next steps

Definitions of creativity

Sternberg 2003: Creativity is the ability to produce work that is novel (original, unexpected), high-quality, and appropriate (useful, meets task constraints).

Ochse 1990: Creative products are original (new, unusual, novel, unexpected) and also valuable (useful, good, adaptive, appropriate).

Amabile 1996: A creative task is heuristic rather than algorithmic.

Prior research

1. Personality traits (Weinert 1990, Amabile 1996, Sternberg 2003)
2. Reconstruction of creative research accomplishments (Rheinberger 1997, Dunbar 1995, Simon 1985)
3. Probabilistic-evolutionary conceptualisations of creative research (Simonton 1999, 2004)
4. Network brokers and innovative ideas (Burt 1992, 2004)
5. Institutional conditions for research breakthroughs (Hollingsworth 2002, 2004)

Overview CREA study

1. Project goals

- a) Identify current highly creative researchers and groups
- b) Understand current organisational and institutional conditions for creative research
- c) Make tentative policy recommendations how to foster creative research

2. Identification of creative accomplishments

- a) Functional typology of research accomplishments
- b) Use of multiple sources: survey, archive and bibliometric data

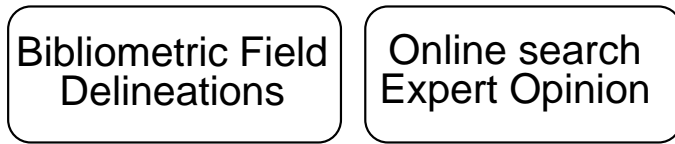
3. Analysis of creative events and research groups

- a) Two fields and regions: nano S&T and human genetics, Europe and US
- b) Period covered: 1995-2004
- c) Qualitative analyses on organisational and institutional aspects: 20 case studies
- d) Quantitative analyses: network structure, disciplinary breadth of highly creative researchers and groups

Typology of creative research

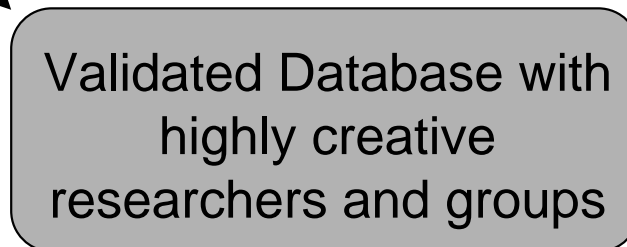
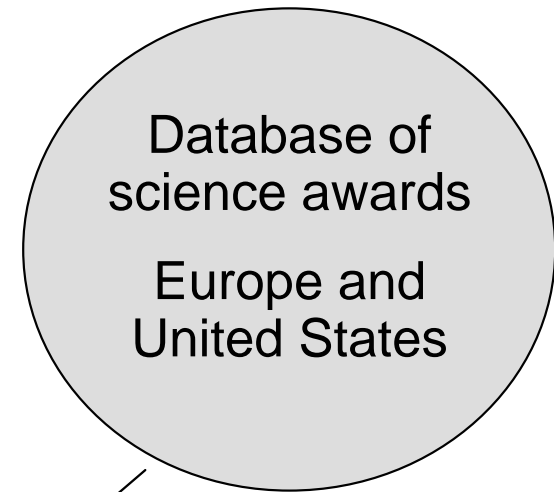
Type of research creativity	Examples
Formulation of new ideas (or a new set of new ideas) that open up a new cognitive frame or bring theoretical claims to a new level of sophistication.	Theory of specific relativity (Physics), Einstein (1905)
Discovery of new empirical phenomena that stimulated new theorising	Biodiversity → Theory of evolution (Biology), Darwin (1844)
Development of a new methodology, by means of which theoretical problems could be empirically tested.	Factor analysis → Theory on mental abilities (Psychology), Spearman (1927)
Invention of new instruments, that opened up new search perspectives and research venues.	Raster Scanning Microscopy → Nanotechnology (Physics), Binnig/Rohrer (1982)
Synthesis of formerly dispersed ideas into general theoretical laws, that enabled analyses of diverse phenomena within a common cognitive frame.	General systems theory (Biology, Kybernetics, Sociology), Bertalanffy (1940), Ashby (1956), Luhmann (1984)

Identification process



Period covered: 1995-2004

Fields covered: Nano S&T, Human Genetics



Nomination Survey

Nomination Panel	Target per field	Expected response rate	Sample needed per field	Response Nano S&T	Response Human Ge- netics
Highly Cited	40	15%	270	55	18
Active academia	20	15%	130	31	15
Active industry	10	15%	70	19	2
Journal editors	15	30%	50	18	4
Funding gatekeepers	15	40%	40	17	6
TOTAL	100	100%	560	140	45

Source: CREA Survey 2005

Field and region of nominated researchers and groups

Region of Nominated Researcher	Nano S&T		Human Genetics		Row Total
	<i>Nominators based in</i>		<i>Nominators based in</i>		
	Europe	US	Europe	US	Europe+US
Europe	99	18	35	3	155
United States	83	101	24	39	247
Other Countries	7	1	0	1	9
Total	189	120	59	43	411

Source: CREA Survey 2005

Respondents could nominate more than one creativity type.

Sample for further analyses

	Nano S&T		Human genetics	
	Europe	US	Europe	US
Multiple prize winners	9 (5)	5 (4)	10 (1)	1 (0)
Multiple nominations	7 (3)	21 (10)	0	3 (2)
Prize winner and nomination	16 (7)	17 (12)	5 (1)	9 (2)
Multiple prize winners and multiple nominations	3 (3)	4 (4)	0	0
Total highly creative scientists	22	29	14	11
Total scientists in database	224	204	150	111

Source: CREA Survey 2005

Parantheses indicate overlap between categories

Next steps

1. 20 case studies (up to 3 in-depth interviews per case)
 - a) History of the creative event
 - b) Work group characteristics: e.g. funding arrangements, disciplinary background of group members, communication pattern, group leadership
 - c) Organisational and institutional aspects: e.g. structure and size, degree of centralisation, clarity of research goals, reputation, funding
2. Bibliometric profiles of highly creative researchers
(Paper by Gerrit Bauer and Thomas Heinze)
 - a) Analysis of various independent bibliometric variables: e.g. publication and citation record, disciplinary breadth, network position
 - b) Constructing causal path model by longitudinal research perspective
3. Analysis of funding programmes for unconventional, high-risk, out-of-the-box research
 - a) e.g. Showcase programme of the Wellcome Trust
 - b) e.g. HHMI investigator programme of the Howard Hughes Medical Institute