

Knowledge environments in universities

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Abstract

Talent, motivation, and wealth of ideas are not the only characteristics determining how successfully a scholar's research and academic career develops. What we academics call creative is never the result of individual action alone. Learning processes and research are situated in environments, organisational structures, and spatial relations. We cannot study scientific creativity by isolating scholars and their works from the social and historical milieu in which their actions are carried out. A stimulating environment and a talented individual must come together and interact before a creative process can occur. This article addresses four questions: What elements constitute a local knowledge environment? How can a local knowledge environment affect learning and research processes? How can one measure the impact of a knowledge environment and avoid the trap of determinism? What theoretical concepts can contribute to the analysis of knowledge environments and the explanation of their impact?

Keywords: knowledge environment, creativity, university, network, mobility, scholars, spatial relations, learning, research, interaction analysis, institutional theory, communicative constructionism

Creative scientists can be inspired or impeded by their knowledge environment

The broad consensus is that science has a history. But does science also have a geography? Is science not supposed to be placeless? In recent years a growing number of scholars have pointed out that the generation, diffusion, and legitimisation of scientific knowledge are influenced by local contexts, knowledge environments, spatial relations, and spaces of interaction (GIERYN, T.F. 2001, 2002; LIVINGSTONE, D.N. 1995, 2000, 2002, 2003; MEUSBURGER, P. 2008, 2009b, 2012a,b; MEUSBURGER, P. and SCHUCH, T. 2010a,b, 2012a,b; OPHIR, A. and SHAPIN, S. 1991; SHAPIN, S. 1998, 2001; WITHERS, C.W.J. 2002). When research on creativity was still in its infancy, it focused on the attributes of geniuses, gifted persons, creative artists, and scientists; creative performance; and problem-solving. Few scholars found it necessary to include the environment in their considerations. At best, they admitted that talented individuals could not develop their creativity in repressive societies.

The way to the interactional and environmental study of creativity was prepared by environmental psychologists concentrating on the relation between actor, situation, and environment, especially by BARKER's concept of action settings (BARKER, R.G. 1968). Scholars pursuing management studies, organisational research, and institutional theory, too, became interested in the psychological climate of organisations, in institutional logics, and in rules and informal norms that structure behaviour (BATILANA, J. 2006; BITEKTINE, A. and MILLER, D. 2015; LAWRENCE, T. *et al.* 2011; MINTZBERG, H. 1979; SUDDABY, R. 2010; SUDDABY, R. and GREENWOOD, R. 2005). They found that creative persons are very sensitive and responsive to formal and informal sets of mutual expectations between people, to quality conventions and evaluation criteria prevailing at their place of work (see RAUDSEPP, E. 1958).

Since the 1980s, more and more scholars have acknowledged that the creative scientist does not work in a social, cultural, and economic vacuum. They have pointed out that people cannot study creativity by isolating in-

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dividuals and their works from the social and historical milieu in which their actions are carried out (AMABILE, T.M. 1983a,b; AMABILE T.M. and GYSKIEWICZ, N. 1989; AMABILE, T.M. *et al.* 1990; AMABILE, T.M. 1996; BODEN, M. 1994, 2004; CSIKSZENTMIHALYI, M. 1988, 1990, 1999; HENNESSEY, B.A. and AMABILE, T.M. 1988; MALECKI, E.J. 2013; MATTHIESEN, U. 2009; MEUSBURGER, P. 2009a; MEUSBURGER, P. *et al.* 2009; MUMFORD, M.D. 1995; RUNCO, M.A. 1988; RUNCO, M.A. and OKUDA, S.M. 1988; SIMONTON, D.K. 1975; STERNBERG, R.E. and LUBART, T.I., 1991, 1999). It has been accepted that creative individuals are inspired or impeded by societal and organisational structures and that they depend on evaluators, critical audiences, research infrastructure, support of key persons, and financial resources. It has been recognised that creative people and research projects may meet with incomprehension, competition, hostility, and social conflict, that interactions play a very important role, that what we call creative is never the result of individual action alone, and that learning processes and research are situated in environments, spatial structures, and spatial relations.

Today most scholars agree that scientific practices vary from place to place and that universities and other sites of knowledge generation and knowledge distribution are not simply locations but social spaces, epistemic venues, and nodes of scientific networks.² In each discipline university locations differ in reputation; endowment with resources; and the incentives, role models, and career opportunities they offer. They also differ in the degree to which their scholars are part of national and international scientific networks (CHARLE, C. 2004; GLÜCKLER, J. 2013) and in the quality and motivation of their students. Different places³ or knowledge environments have a bearing on whether and how soon new scientific concepts, practices, or techni-

cal innovations are accepted and acted upon and whether it is possible to discuss contested ideas, conduct expensive experiments, hear promptly of crucial developments, and meet with agreement, benevolent tolerance, or criticism upon airing new ideas or breaking the conventions of one's discipline.

Talent, motivation, and wealth of ideas are not the only characteristics determining how successfully a scholar's research and academic career develops. A stimulating environment and a talented individual must come together and interact before a creative process can occur (see STERNBERG, R.E. and LUBART, T.I. 1991). The geography of science is interested in a number of questions. For example, why has a specific research field developed at university A and not at universities B or C? Why have some universities produced and attracted a host of outstanding scholars, whereas others have not? Why does the large majority of outstanding scholars (e.g., Nobel Prize winners) stem from only a small number of universities? Which factors, expectations, or institutional logics inhibit or promote the potential scientific creativity of actors? Which factors influence the career and spatial mobility of scholars? Why does science travel in the selective way it does? How does a local knowledge environment affect research processes and how can these effects be explained? How do international networks of scientists evolve and which long-term consequences do they have? What are the preconditions and primary sources of paradigmatic change in various disciplines and which barriers and facilitators of change can be identified?

As creativity is domain-specific, different domains (e.g., science, humanities, arts, and fashion) need different knowledge environments. This article focuses on knowledge environments of universities. A university's knowledge environment is definable as the result of systematic interdependencies and causal interactions relevant to the generation, diffusion, and application of scientific knowledge.⁴ A knowledge environment should not

² For the role of places in occupational science see ROWLES, G.D. (2008).

³ Various concepts of space and place are discussed by HARVEY, D. (2005) and MASSEY, D. (1999, 2005), for example.

⁴ Some authors prefer the term *knowledge milieu*.

be thought of as an independent variable that directly influences all actors through a direct cause-and-effect relation (if A, then B). It is rather a locally available potential or a local range of resources. It stands for incentives, challenges, stimulations, opportunities, and support networks that can be used, overlooked, or ignored. A knowledge environment can operate as it should only if the actors involved use the local resources and interact with each other. The outcomes of human interactions and experiences in life are always indeterminate. No one can predict the results of appropriation and interaction, whether and how often the local potential for integrating diverse viewpoints and knowledge bases will be activated, and how the relationships between creative agents will develop. Therefore, a knowledge environment's significance and effect can be analysed only after events have taken place, after the scientific careers and research results associated with that environment have become evident.

The article deals with four questions: What elements make up a local knowledge environment? How can a local knowledge environment affect learning and research processes? How can one measure the impact of a knowledge environment and avoid the trap of determinism? What theoretical concepts can contribute to the analysis of knowledge environments and the explanation of their impact?

What elements make up a local knowledge environment?

Personal resources

The most important elements of a knowledge environment at a given place are its human beings with their competencies, skills, experiences, emotions, networks, scientific reputation, manner of interacting with other people, and other personal characteristics. A university is a junction of the paths along which careers are pursued by the academics of various disciplines, generations, and provenances for

a specific period of time. This intersection of career paths at a particular place (for career paths of Nobel Prize winners, see MAGER, C. 2012) can channel highly diverse bodies of knowledge, research interests, theoretical concepts, international experiences, networks, quality standards, and methodological expertise into a knowledge environment, or space of thematic communication, where they undergo critical discussion and where their value is tested in research processes.

Because people are the most important part of a knowledge environment and because their interactions, learning processes, and conflicts are not foreseeable, a knowledge environment is never stable or immutable; it is constantly changing. If a university's knowledge environment is to remain attractive, competitive, and resilient in its quality and scientific reputation, it must be continually replenished by the best available candidates bringing in new ideas, new competence, new scientific methods, and new networks. Scholars socialised in other knowledge environments will question or subtly change some of the prevailing institutional logics, interpretations, and justifications and will bring in new research interests, new kinds of organisational structures, and new repertoires of scientific practices. Some scholars criticizing the theoretical mainstream in their discipline will have an interest in counter-hegemonic practices (see CLEGG, S. 2010, p. 8), and some of them will even be able to exert important effects on governance structures (DACIN, M.T. *et al.* 2002, 51–52).

A knowledge environment operates by the Matthew effect: The more you have, the more you get. The higher the scientific reputation of a university, the more it acts as a magnet attracting talent and brains, and the more impressive its global networks are. Creative, talented people tend to be attracted to certain institutions and places where they can develop their abilities and ideas, have the occasions to interact with other knowledgeable agents, procure the necessary support, be inspired, tackle challenges, and command the necessary resources.

This kind of constant renewal comes about not only through the recruitment of new scholars⁵ but also through what is known as research travel, circular mobility, such as brief periods of study or research abroad, scientific cooperation, and conferences. Mobility of scholars is extremely important for universities. It can trigger new ways of thinking and learning and can bring about new cooperation in the world of science. Mobility means gathering experience in different knowledge environments, tackling new challenges in different departments and scientific domains, exposing one's research ideas to new criticism, and familiarising oneself with issues and methods one has not yet encountered at previous places of work. Learning processes and careers of scholars do not usually take place in a single environment. Scholars are expected to work successfully at more than one university or institutional setting so that they can accrue a wealth of experience, develop extensive personal networks, and constantly broaden their methodological spectrum.

The mobility of scholars can be analysed with various methods and indicators. Some of the most frequently used are the regional provenance, career paths, and scientific travel of the people in question (ACKERS, L. 2005; BAAR-CANTONI, R. and WOLGAST, E. 2012; HARVEY, W. 2010; HEFFERNAN, M. and JÖNS, H. 2013; JÖNS, H. 2007, 2008, 2009, 2014; MEUSBÜRGER, P. and SCHUCH, T. 2010a,b, 2012a,b). Scientific relations can be measured by collaboration in joint research projects (BUKAU, B. and TOLLE, R. 2012; RADITSCH, L. 2012; SELTMANN, S. 2012), the distribution of coauthors in joint publications (WELLNITZ, E.M. 2012), the spatial distribution of former graduates of a professor or faculty (ECKART, W.U. *et al.* 2012), networks of scholars, the spatial distribution of an author's correspondence (KÜHLMANN, W. *et al.* 2012), and many other indicators.

⁵ There is a mutual relationship between the reputation of a university and the size and diversity of its recruitment area of professors (MEUSBÜRGER, P. and SCHUCH, T. 2010a,b, 2012a,b).

Material and financial resources

The next important elements of a knowledge environment are its financial resources and the quality of its research infrastructure. Whether outstanding scholars are attracted to a given university often depends on that institution's basic material wherewithal, its financial strength, the quality of its research infrastructure (e.g. physical facilities, libraries, laboratories, and computing centers), and the architecture of a campus. Many new questions can be studied only if the latest research equipment, analytical methods, or archives are on hand. The more expensive such material resources are, the lower the number of universities that are able to acquire them. However, philosophers or mathematicians are less place-dependent for their research than experimental physicists, who may find only three locations in Europe where they can conduct their costly experiments.

In order to attract the famous chemist Robert Bunsen (1811–1899) in 1852, the government of the Grand Duchy of Baden funded a state-of-the-art chemistry laboratory building, the most modern in Europe, and probably in the whole world. In the second half of 19th century, the Grand Duchy of Baden spent about 4 percent of its state budget on its two universities and a technical college, and its per capita expenditures on universities exceeded those of any other German state (PFETSCH, F.R. 1974). Robert Bunsen was a prime reason why other exceptional scientists, including Hermann Helmholtz (1821–1894), Robert Kirchhoff (1824–1887) and others joined the staff of Heidelberg University and created a research center of world-wide reputation (for details see ECKART, W.U. *et al.* 2012; HÜBNER, K. 2010; MEUSBÜRGER, P. 2012a,b).

Immaterial and organisational resources

Although above-average financial and material endowment is crucial to a university's attractiveness, it by no means guarantees excellent scholarship. Whether an academic

performs unusually well also depends on a site's various immaterial factors, which constitute the third element of a knowledge environment. Some of them pertain to the institutional regulations, conventions, mutual expectations, and organisational structures under which the scholars try to meet their goals. These factors extend to the questions of how key decisions on structural changes and resource distribution come about within a university. The immaterial factors also include the customary quality standards for research and teaching, the degree of academic freedom, rhetorical strategies of legitimacies (SUDDABY, R. and GREENWOOD, R. 2005), and the issue of whether there is respect for diversity among professional cultures or whether one discipline's rules for evaluating academic performance are imposed on all others. The basic nonmaterial resource of a scientific institution consists largely of the academic reputation ascribed to it.

Institutional theory and research on creativity recognise the constraining effect that institutional norms, conventions, and meaning systems have on the emergence of new theories, new research paradigms, and research methods (BITEKTINE, A. and MILLER, D. 2015, p. 117). "Actors perceive the meaning of institutions and infuse their actions with meaning based upon these perceptions" (DACIN, M.T. *et al.* 2002, p. 47). However, members of a university are not passive actors. They are involved in institutional work, and some of them are able to change the rules and meanings of their institution. There is a "dialectical interplay between ... *actions* (practices and structures), *meanings*, and *actors*" (ZILBER, T.B. 2002, p. 235; emphasis in the original; see also DACIN, M.T. *et al.* 2002, p. 48). Institutional work "describes the practices of individual and collective actors aimed at creating, maintaining, and disrupting institutions" (LAWRENCE, T. *et al.* 2011, p. 52). Individuals of high social status (high scientific reputation) are better prepared than others to resist and challenge the conforming pressures of institutions (BATTILANA, J. 2006).

How can a local knowledge environment affect learning and research processes?

Young scholars and students operate in an environment of "pre-organised knowledge" (KNOBLAUCH, H. 1995, p. 15). Most of them are influenced by what the prominent members of their department or university view to be established knowledge; promising topics, methods, and experiments; and acceptable theories. These up-and-coming academics are inspired or impeded by organisational structures and institutional rules. Their scientific goals and spaces of interaction are influenced by evaluators, role models, critical audiences, institutional regulations, informal expectations of their social environment, and a multitude of other factors. Few students or prospective scientists are able to ignore the expectations and conventions communicated in their social environment.

Institutions, places, locales, and environments are ascribed an indispensable role in the generation of career paths. Just as certain time periods offer different windows of opportunities and risks, certain locales and spatial contexts (DIEKMANN, A. 2014; FRIEDRICH, J. and NONNENMACHER, A. 2014) offer different learning opportunities, role models, value systems, challenges, social networks, and opportunities for professional careers. The institutional, cultural, and social context in which a young person studies or in which a young scientist does research and teaches can be elemental in determining the research topics they will find of interest; the methodological skills they will acquire; the scientific networks they are able to join; the kind of critique and support they will encounter; and the interesting, unsolved problems they will notice. Support from key figures in their discipline will affect the initiative, resilience, and subsequent perception that these young academics have of their roles as lecturers and researchers. Daily interaction with positive (or negative) role models and personal relationships has lost none of their significance in the age of the Internet. On the contrary, the overwhelming flood of information has only increased the importance of

face-to-face contacts with leading thinkers from the relevant disciplines. As a space for experience, perception, or experimentation, the site and surroundings of a university can also give scientific stimulation crucial to research programs, especially in disciplines where field research, spatial data, or expensive experiments are vital.

Knowledge environments can influence the reading or interpretation of scientific knowledge as well. The interpretation and application of new knowledge depend chiefly on the prior knowledge, interests, and prejudices of its potential recipients. A textbook example often cited in *Science Studies* (LIVINGSTONE, D.N. 2003) concerns the reception of Darwin's main work, *On the Origin of Species* (1859). It was interpreted differently in Russia than in Canada, and differently in Belfast than in Edinburgh. In Charleston it was seen as an argument for racism; in Auckland, as one against it. Immediately after the book was published, the Heidelberg paleontologist Heinrich Georg Bronn (1800–1862), who was also the rector of Heidelberg University at the time, translated it into German, a version that appeared in 1860. Bronn enjoyed a good personal relationship with Darwin. Their bond, though, did not keep Bronn from reading Darwin's work very selectively and incorporating elements of his own perspectives into the translation (MEUSBURGER, P. 2012a, p. 16).

The places where scholars have been academically socialised are very important for their later career. However, scientific careers are not a random sequence of events but rather "contingent series of events" (WELSKOPP, T. 2002, p. 79) that follow a definite logic and rest on particular mechanisms. In individual cases certain events are therefore linked with each other, and a rationale can be found for the steps in a scholar's career. Prominent scholars indisputably play a major part in shaping the development and careers of talented students. The identity of scholars is defined not only by what they do but also by *where* they do it. People trust the academic reputation of excellent universities

or departments even if unfamiliar with any of the scholars working there. Place names such as Berkeley, Cambridge, or Heidelberg serve as a kind of shorthand for complex circumstances surrounding the practice and standards of science.

What makes a location attractive is its possible or imagined advantages, not the realised ones. Because nobody is able to unravel the complexity of interaction, learning processes, and institutional decision-making, the appraisal of a scientist's potential is closely tied to the places at which that person earned his or her doctorate, did postdoctoral work, or received a professorship. A scholar who was trained at a distinguished research department has credibility from the outset because the scientific reputation of a place or institution is reflected back onto the scholars working there. The history of science is replete with evidence of how a head start translates into a crucial advantage in a scholar's later career and creates important path dependencies.

Each university has its own academic history, body of myths, and major narratives that contribute to a collective identity and reputation. The symbolic meaning, reputation, and attractiveness of a university lie not only in its present merits and achievements but also in those gained previously by scholars no longer belonging to the context. A place is like a screen on which possibilities, expectations, benefits, and hopes are projected. These collective memories and narratives can be reinforced by an iconography of the space and by place-making. Plaques on buildings and memorials constantly remind the informed passer-by of past achievements by famous scientists or of important events in the history of science, imbuing particular places with a symbolic significance as well. An awareness of the city's iconography and recurring contact with places important in the history of science can instill in scholars and students an emotional bond and personal identification with their university. It can inspire them with scholarly role models and can create spaces of identity.

How can the impact of a knowledge environment be measured?

The study of knowledge environments is a multilevel process at various scales of aggregation, all of which are interconnected. First, the quality of a knowledge environment of academic institutions can be studied for the scientific accomplishments, professional success, or academic reputation attained by their scholars or graduates in a given period. There are numerous questions to pursue in this regard. For instance, what pioneering publications have originated in a particular institute? What new ideas, methods, and theoretical concepts have come from a given institute? How many of an institute's graduates have been appointed to professorships or prominent positions outside academia? How many of a university's scholars have received outstanding scientific awards (e.g., Nobel Prize, Fields Medal,⁶ or honorary doctorates)? How often have its members been engaged as reviewers by international journals and major institutions of research funding or in important evaluation procedures?

This first approach allows inferences about the quality of the knowledge environment without opening the black box of causes and relations and without discussing the personal experiences of the given scholars. This method communicates the external perspective and is useful especially at the highest level of aggregation or with large-scale comparative studies that cannot delve into the biographies of a large number of individual scholars. *Figure 1* shows, for example, that former doctoral candidates and assistants of Heidelberg chemist Robert W. Bunsen came to occupy numerous chairs and other prominent positions in the chemistry departments throughout Europe (ECKART, W.U. *et al.* 2012, p. 98). In addition, a number of prominent U.S. chemists had studied under Bunsen (HONECK, M. and MEUSBURGER, P. 2012).

If so many successful scientists hail from one department, one may legitimately con-

clude that a very stimulating and unusually creative knowledge environment had existed there during a certain period. Such recruitment of scientists to other universities not only promotes knowledge transfer and creates important networks but generally intensifies the sway that the home institutes have over their discipline. *Figure 1* also suggests what an international power center Heidelberg must have been in the field of chemistry during the second half of the 19th century. Such internationally important nodes of scientific networks often dominate the review process in recruitment procedures and have a strong impact on scientific journals.

The second approach for studying knowledge environments centers on the social relations, interactions, and networks of the scholars working at a given place and on the processes of *appropriation* as meant by GRAUMANN and KRUSE (GRAUMANN, C.F. 1996, 2002a,b,c; GRAUMANN, C.F. and KRUSE, L. 2003). A local cluster of illustrious and globally networked scientists does not automatically equate with knowledge exchange, scientific cooperation, mutual inspiration across disciplines, or a creative environment. Although proximity can facilitate unplanned, spontaneous, face-to-face contact, it does not guarantee interaction. What counts is whether and to what extent the scientists at a university interact and engage in cross-disciplinary discussion (CHRISTMANN, G.B. 2013; KELLER, R. *et al.* 2013; KNOBLAUCH, H. 2013; LEPSIUS, M.R. 2012; TREIBER, H. and SAUERLAND, K. 1995), how they manage their social relations in that environment, and whether the area's creative potential is activated. A knowledge milieu does not emerge until the actors communicate and interact with each other; come to grips with the structural conditions, institutional regulations, and organisational cultures in which they find themselves; and prove themselves willing and able to activate the locally available potential and change organisational structures and conventions. The key words are not *cluster* or *proximity* but *communicative interaction* and *ways to transcend the silo mentality*. It is the potential to communicate with

⁶ International Medal for Outstanding Discoveries in Mathematics.

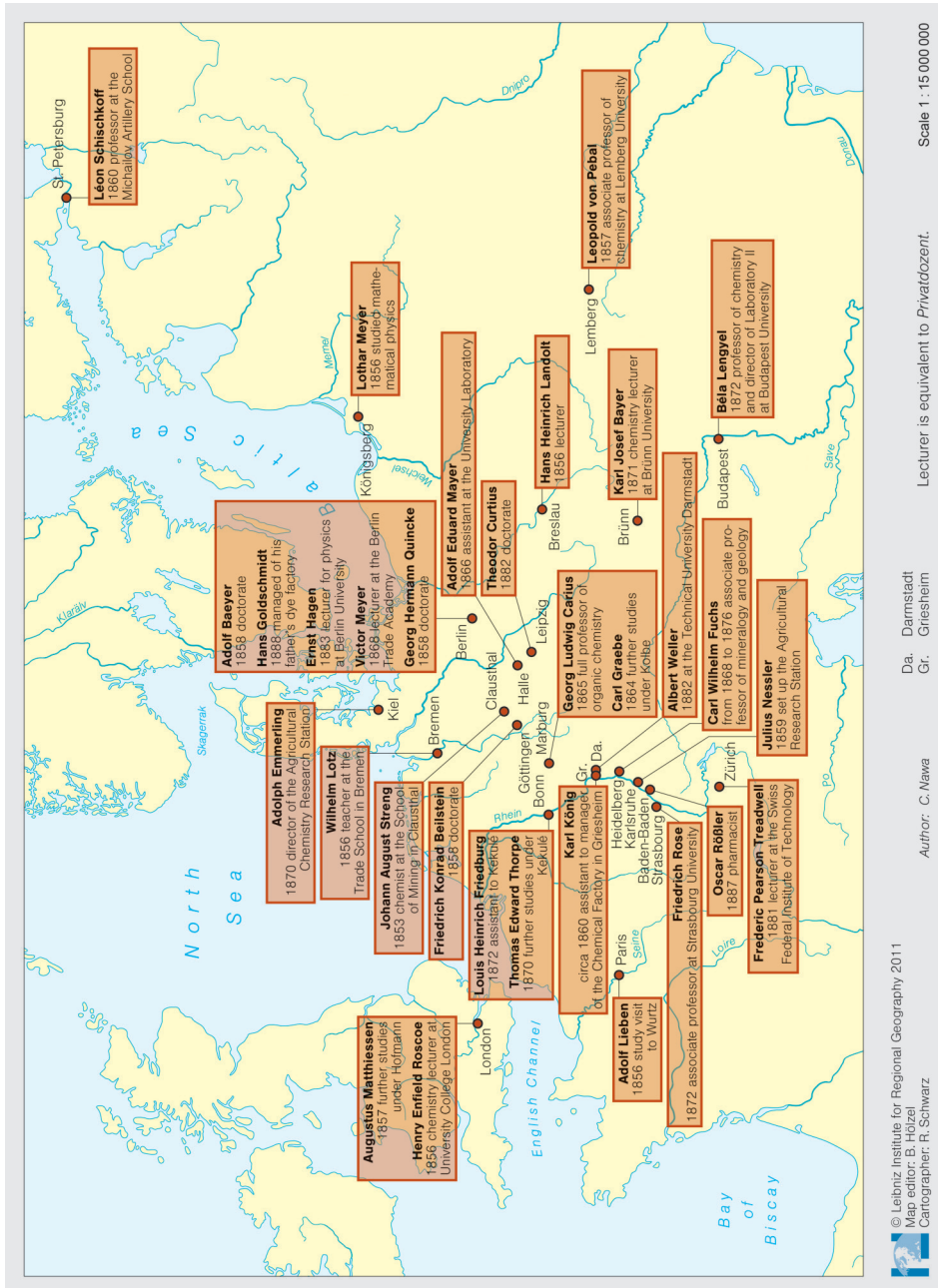


Fig. 1. Chairs and other prominent research positions of former doctoral candidates and assistants of Heidelberg chemist Robert Bunsen (1811–1899). Source: ECKART, W.U. *et al.* 2012, p. 98.

other highly creative persons that attracts artists and scientists from elsewhere.

Processes of appropriation are often taken for granted and underrated, but there are many local opportunities, resources, stimuli, support, services, and challenges that academics may fail to use to their own advantage. Research equipment whose potential is not exploited, books that remain unread, and contacts that are never activated cannot have any effect on learning and research. Without the processes of appropriation, knowledge transfer is impossible in many cases.

The main theories and methodologies of this second approach to the study of knowledge environments are interaction analysis, the micro-scale of institutional theory⁷ and network analysis. “The dimension of interaction analysis is about clarifying the conditions under which effective problem-solving is achieved or not in the institutionally structured interaction of actors at the meso- and macrolevels” (SCHARPF, F.W. 2002, p. 213). This second approach turns attention to several questions: How do scholars interact with each other? How much are the life worlds of various disciplines at a university or in a knowledge city communicatively interlinked? Which persons or departments are the ones bridging between disciplines or serving as the key nodes in networks? How do people engage with the basic local conditions and power structures under which they try to reach their objectives? How have institutions or individual actors affected these very conditions?

The third way to analyze knowledge environments revolves around the professional career of individual scholars, taking into account what they have subjectively experienced, how they have personally evaluated

their knowledge environment. According to WELSKOPP “All structural interrelations must . . . be tracked through the consciousness of the participants as it were, although multiple discerning rounds of translation and decoding will be necessary” (WELSKOPP, T. 2002, p. 76).

This approach involves the attempt to reconstruct the influences and watersheds that shaped the academic aspirations, research interests, methodological expertise, and career trajectory in various phases of the particular scholar’s career. Most academics are able to recall with relative accuracy who they were decisively influenced and inspired by as students; what personal strengths and weaknesses their professors had; what intellectual standard the doctoral seminars had; the times, places, and people of the critical junctures in their professional success or failure; the time and circumstances relating to their development of a new scientific idea; the way in which their immediate social environment and their academic discipline responded to new ideas; and the reasons that particular research projects could not be pursued. The research taking this approach is based on interviews, memoirs, and correspondence; on the scholar’s own account of his or her professional career; on biographies and autobiographies; on minutes of meetings; and on reports by persons from the social context. This third approach has a long tradition in the history of science but has been only rarely used to describe knowledge environments.

Most scholars will agree that it is much easier to count organizational structures, financial resources, career steps, networks, scientific awards, scientific accomplishments, patents, impact factors, or the success of a professor’s students than it is to measure meaning systems, academic aspirations or the exchange of ideas.

Theoretical concepts contributing to the understanding of knowledge environments

Anyone interested in the influence of knowledge environments on the learning process-

⁷ Issues of power and dominance are widely excluded in the macro-perspectives of institutional theory (see HUDSON, B.A. *et al.* 2015; WILLMOTT, H. 2015). “In most institutional theory, examination of the relatedness of knowledge and power is deemed to be largely irrelevant; the self-understanding of institutional theory as politically neutral is self-evident; and the silence of institutional theory on contentious issues, such as the institutionalization of domination, oppression, and exploitation in modern work organizations, passes unnoticed” (WILLMOTT, H. 2015, p. 106).

es, academic socialization, and the careers of scholars seeks theoretical approaches that can bring out the patterns of interaction and communication between actors, institutions and their environment, and the underlying general mechanisms. These approaches must be able to deal with the tension between a knowledge milieu's conditionality, which is in principle historical and local, and "efforts to formulate generalizing concepts and generic explanations" (ESSER, H. 2002, p. 128).

The study of knowledge environments is a multilevel enterprise comprising a broad range of methods and theoretical concepts. It has already been mentioned that creativity research, organization theory, and institutional theory can explain the relations between structure and agency to a certain degree (LAWRENCE, T. *et al.* 2011; MINTZBERG, H. 1979; SUDDABY, R. 2010; SUDDABY, R. *et al.* 2010; ZILBER, T.B. 2002). Institutional theory provides "new understandings of the manner in which institutions are created, transformed, and extinguished and the way in which institutional processes interact to affect institutional change" (DACIN, M.T. *et al.* 2002, p. 45).

"The concept of institutional work insists on the need to consider the permanent recursive and dialectical interaction between agency and institutions. This invites researchers to not only account for the institutional embeddedness of actors but also for their capacity to reflect on this embeddedness, relate to their own self, and develop conscious intentionality. Agency is neither just an effect of the actors' institutional embeddedness nor isolated from this embeddedness. It is an ongoing activity whereby actors reflect on and strategically operate within the institutional context where they are embedded" (LAWRENCE, T. *et al.* 2011, p. 55).

In addition to frequently applied concepts focusing on individual actors (e.g., biographical studies), institutions, and organisations, there is a need for concepts focusing on social macrophenomena and holistic explanations (e.g. gestalt psychology, environmental phenomenology). Some scholars hold that one cannot describe place experience, knowledge environments, or life worlds by precisely dis-

secting them into constituent parts and then quantitatively "measuring" and modeling the significance of the discrete variables.

Due to the complexity and historicity of the subject, students of knowledge environments are less concerned with the discovery of causalities in the sense of universal laws than with the causal reconstruction of the network of interactions (see MAYNTZ, R. 2002, p. 22). According to MAYNTZ, what is sought in the empirical analysis of social macrophenomena is "not abstraction and maximal simplification but rather specification and adequate complexity of the explanation" (MAYNTZ, R. 2002, p. 13). "Causal reconstruction is not about seeking statistical relations between variables but rather about explaining the macro-phenomenon by identifying the processes and interdependencies involved in its having arisen" (MAYNTZ, R. 2002, p. 13). Systemic interdependences are about mutual dependence and influence in the relations between different simultaneous processes or between different institutions. The discrete processes or institutions are parametrically linked with each other as it were; that is, they can reciprocally change important basic conditions for each other (MAYNTZ, R. 2002, p. 33).

In gestalt psychology perception and other mental processes are regarded as holistic rather than atomistic in nature. That is, complex perceptual and cognitive patterns are grasped in their entirety as integral wholes (gestalts), rather than pieced together from simpler sensations or "atoms of experience." A musical melody, for example, is not simply a summation of the individual notes that it contains. The melody is given in experience as a whole, and the character of each individual note is determined by its place within that whole (SCHROEDER, H.W. 2007, p. 295).

"The starting point for FULLER's phenomenological account of gestalt psychology is the life world of human experience (FULLER, A.R. 1990). "Life world" (*Lebenswelt*) is a term coined by HUSSERL to denote the original, meaningful, everyday world in which people actually live. The task of phenomenological description and interpretation is to explicate hidden

structures of life world meaning that hitherto have been lived only in an implicit, unreflective way" (SCHROEDER, H.W. 2007, p. 299; see also HUSSERL, E. 1986).

SEAMON characterises environmental phenomenology as striving for a holistic view of place, in which the various parts of environmental experience are understood as reciprocally related to each other and to the larger geographical whole to which they belong (SEAMON, D. 1987). He describes the phenomenological essence of place as "a psycho-social environmental whole larger than the sum of its parts" (p. 20; see also KEEN, E. 1975; McCALL, R.J. 1983; SCHROEDER, H.W. 2007; SEAMON, D. 1982).

Communicative constructivism is an approach to explaining how reality (*Wirklichkeit*) accrues through elaborate processes of transmitting, exchanging, and negotiating thoughts, information, ideas, and messages. Communication is not reduced to language but rather understood as a human practice by which identity, relationship, society, and reality are ascertained, evaluated, and categorized (BERGER, P.L. and LUCKMANN, T. 1967; CHRISTMANN, G.B. 2013; KELLER, R. *et al.* 2013; KNOBLAUCH, H. 2013).

Conclusion

Research on knowledge environments will neither replace traditional science studies nor studies about the biographies and careers of individual scholars or studies about academic networks. But studying venues, environments, or social spaces of academic knowledge generation opens up new horizons for explaining interrelations and path dependencies of academic careers and academic achievements.

As with historical theories, knowledge environments can be credited with "a retrospective forecasting ability" (WELSKOPP, T. 2002, p. 83; see also THELEN, K. 2002). In other words, it is possible to formulate a post hoc explanation of how relational networks between human and institutional agents have

affected observable scientific practice (see WELSKOPP, T. 2002, 76–77). The reconstruction and description of knowledge environments after the fact, however, is tied to "epistemological and discursive conditions of the present" (WELSKOPP, T. 2002, p. 78) and can therefore be revised the moment new information surfaces or scientific standards and criteria of judgment change.

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