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Bringing “New Science” into Careers Research

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This paper reflects on the first author's attempts to adapt traditional social science methods to her own purpose. The research involved developing a methodology to explore the subjective career, concerned with people's internal, self-referential views of their unfolding career experiences. The paper describes a series of problems encountered along the way, stemming directly or indirectly from the rigidity of traditional science assumptions. In contrast, the authors find encouragement in contemporary ideas about “new science,” and its imagery of a self-organizing, non-linear and interdependent world. The journey leads to philosopher Paul Cilliers' principles of complex social systems, which provide an alternative, and more affirming, platform for the kind of research undertaken.

Social science research is at an interesting juncture. Its accepted tradition, stemming from the physical sciences, involves an «objective, logical and systematic method of analysis devised to permit the accumulation of reliable knowledge» (Lastrucci, 1963: 6). However, this “traditional science” methodology has come under increasing scrutiny. An alternative “new science” approach (Wheatley, 1992) suggests recent physical science views of shifting, interdependent and self-organizing relationships provide alternative inspiration. Moreover, this alternative approach suggests a range of new ways to think about careers research (Bird, Gunz and Arthur, 2002, this issue).

Kuhn (1970: 36) describes traditional science—“normal” science—presuming a puzzle metaphor. The presumption is that problems can be reduced to distinct forms such as crosswords or jigsaw puzzles. In these puzzles the parts remain the same, only fit together one way, and are fixed in relation to each other. The puzzle metaphor suggests that careers will unfold through prevailing organizational or institutional parts, namely jobs. However, the jigsaw puzzle metaphor does not work very well any more for many of the problems intriguing much of the contemporary scientific community, even though in Kuhn's terms this may still be “normal” (i.e., non-paradigm-shifting) science. Those problems—reflecting ideas in chaos theory, complexity theory and non-linear systems (e.g., Holland, 1996; Capra, 1996)—involve seeing the relationships between the parts, as well as the larger pattern that the relationships create, as constantly changing. Such views resonate with contemporary ideas about how adaptive, self-organizing career processes contribute to the economic and social world (Weick, 1996).

The traditions of social science research place the contemporary careers researcher on the horns of a dilemma. Can changing relationships be explored through methodologies which presume that those relationships will endure? Can a supposedly non-linear world be reconciled with the linear assumptions on which most social science methods are based? Can these methods be adapted to accommodate interdependence rather than assuming separate independent and dependent variables? Even if the methods are adaptable, how will the adaptations be seen by the gatekeepers—the academic supervisors and journal reviewers—of social science research? Does the common distinction between quantitative and qualitative research help or hinder the troubled researcher? This paper will explore how questions such as these were experienced in a recent career research project.

The purpose of the research project, begun in 1995, was to develop an understanding of individuals' subjective careers based on a new conception of the career, namely the "intelligent career" (Arthur, Claman and DeFillippi, 1995). This conception was inspired by previous work on the subjective side of the career (e.g., Schein 1978; Barley, 1989), reflecting the meaning that people ascribe to their own career situations, in contrast to the objective career reflecting the normative roles and sequences of roles suggested by prevailing organizational and occupational structures. The subjective career involves the internal interpretation of personal experiences, the internally perceived place of work in the whole of one's life context, and the internal sense an individual makes of the unfolding of events over time (Barley, 1989). The subjective side has been broadly argued to be increasingly significant as individuals are called on take greater responsibility for both the direction and interpretation of their unfolding careers (Arthur and Rousseau, 1996a; Hall, 1996). We anticipated that the subjective career data we sought might well be elicited through a card sort technique, known as a "Q-sort," and described to offer «a fundamental theory of subjectivity, beginning and ending with expressions of self-reference» (Ozer, 1993: 104).

This is not a conventional research paper. Our primary aim is not to report on the findings of a research project. Rather, our aim is to describe the difficulties we encountered and the learning we drew as the project progressed. In particular we will attempt to show how several of our difficulties stemmed from the application of traditional social science assumptions. We will then turn to suggest that "new science" offers an alternative set of assumptions more compatible with our research purpose, and with the conception of career behind it. We will close by encouraging careers researchers to take the ideas of new science to heart, rather than to be constrained by the increasingly questionable assumptions to which traditional social science adheres.

THE "INTELLIGENT CAREER"

Our point of departure was the intelligent career (Arthur et al., 1995), originally conceived as a response to Quinn's (1992) ideas about

“intelligent enterprise.” Quinn’s “new paradigm” saw company success stemming from the perpetual accumulation and conversion of “intellectual resources” into desired customer outputs (Quinn, 1992: 213). He envisioned a turbulent environment, including a turbulent employment environment, as a permanent rather than passing feature of the economy companies faced. He also described employment as “voluntary” in that «the best people [didn’t] have to work for [any] particular company,» staying only as long as they wanted to be there (Quinn, 1992: 151). The challenge for both company and career adaptation concurred with other viewpoints asserting that employment mobility would be an enduring and important feature of the emerging economy (Bridges, 1994; Drucker, 1994).

Quinn’s work overlaps with a broader set of ideas linking company success to the underlying “core competencies” through which the company does its business (D’Aveni, 1994; Hamel and Prahalad, 1994). These competencies fall into three distinct categories concerned with a company’s culture, know-how and networks respectively (Hall, 1992). Briefly, culture encompasses the dominant values and beliefs through which a company functions, know-how involves a company’s accumulated skills and expertise, and networks represent the relationships through which a company participates in the economic marketplace.

The intelligent career framework responds to these categories by suggesting three corresponding “ways of knowing”—labeled knowing-why, knowing-how, and knowing-whom (Arthur et al., 1995). The framework takes Quinn’s and other writers’ assertion of “voluntary” employment to heart. Accordingly, the career actor is seen as a temporary investor in his or her present company, rather than as subservient to the company’s proclaimed (and often shifting) goals and objectives. The three ways of knowing may be briefly described as follows.

Knowing-why relates to company culture, and involves themes of individual motivation, the construction of personal meaning, and the expression of identity through work. Knowing-why further incorporates attitudes to and accommodation of a person’s family, and sentiments about other non-work aspects of life that affect career choice, adaptability and commitment.

Knowing-how links to overall company know-how, and reflects the skills and expertise a person brings to his or her work situation. However, people may well bring, or may wish to develop, broader knowing-how competencies than their present job demands. People may therefore be expected to seek to change their work arrangements to enhance future career opportunities and employability.

Knowing-whom involves the internal and external relationships that contribute to a company’s networks. Some relationships are prescribed by the company’s job expectations, others grow from less formal beginnings. Connections to other company departments, suppliers, customers and so on can support people’s career purposes, as can contacts with family, friends, and professional acquaintances.

It is fundamental to the intelligent career framework that the three ways of knowing are interdependent. For example, a person’s (knowing-

why) career motivation can be expected to influence his or her further investment in (knowing-how) expertise, as well as in (knowing-whom) relationship-building to help develop that expertise. In turn, fresh expertise and new relationships can be expected to influence future (knowing-why) motivation, and so on. It is also fundamental that the interactions will change over time. Yesterday's (knowing-why) enthusiasm or (knowing-how) learning agenda or (knowing-whom) affiliations can be expected to change in the light of subsequent experience. The intelligent career view sees people, like their employer companies, to be engaged in perpetual adaptation.

Each of these three types of knowledge also has interrelated referents: the job, the company, the professional domain, and the industry. Again as careers develop, one or other of these domains may be salient to the individual. In addition, learning in one domain may contribute to knowledge in another.

THE RESEARCH PROJECT

As previously stated, the intention of the research project was to explore subjective career data, based on the intelligent career framework. The preliminary plan for the project was as follows. The initial research participants would be MBA graduates, an accessible local population that was predictably already adjusting to "voluntary" employment principles (Kotter, 1995). Preliminary evidence of the population's career concerns would be gathered from a series of case studies. These would precede three focus groups with MBA graduate participants, which would draw on the intelligent career framework in promoting participants' discussion of their own career behavior. The focus group transcripts would provide the raw data from which two methodologies would be developed. In the first, a traditional paper and pencil questionnaire covering each of the intelligent career domains was developed. The data from this was analyzed through factor analytic techniques. Second, the same data from the focus groups together with the insights developed from the factor analysis data were used to develop items to be used in a card sorting exercise. It was felt that these alternative methods would provide useful triangulation of the concepts implied by intelligent career theory. In addition, we expected that the traditional questionnaire and the card sort items would provide a convergent picture of the careers involved¹.

1. When the project was launched the first author was a graduate student in an urban business school with a substantial population of local MBA alumni and MBA students that made the research project viable. As a graduate student, her work would be subject to both internal advisors' and external assessors' approval of her research program, and of its appropriateness in the field of social science research. We mention this because of the subsequent challenges involved in conducting and reporting the research. The second author was a visiting professor when the research project began, and an originator of the intelligent career approach (DeFillippi and Arthur, 1994; Arthur, Claman and DeFillipi, 1995). We will tell our story as it happened, citing the academic references we drew upon at the time, so that the reader may better relate to the experiences reported.

RESEARCH EXPERIENCES

Over the course of the ensuing research, several experiences reflected a tension between traditional social science principles and the authors' aspirations. These involved the initial adoption of factor analysis, the further interpretation of factor analysis results, the principles underlying a relevant branch of social science research called Q-methodology, the approach to scoring the card sort results, and the

distinction between quantitative and qualitative methodologies². These experiences are described below.

Adopting factor analysis: The research proceeded smoothly through its case study, focus group and questionnaire phases. A content analysis of the focus group transcripts suggested a total of 87 prospective card sort items, broken down into 35 knowing-why, 26 knowing-how and 26 knowing-whom items respectively. Example items were: "I want to contribute to innovation at work" (knowing-why), "I pursue skills and knowledge specific to my occupation" (knowing-how), and "I develop and maintain relationships inside my industry" (knowing-whom). The items were included on a questionnaire distributed among current MBA students (the student were all part-time, and therefore active in their own careers). Ninety-five students responded out of 110 approached.

Our first attempt at factor analysis was a conventional one, to enter all of the questionnaire items into the factor analysis at the same time (Harman, 1976). The results were not encouraging; there was only limited evidence for three distinct knowing-why, knowing-how and knowing-whom dimensions. Our next conventional approach was to ask the analysis to confirm a three-factor solution, but again the results failed to provide the distinctions sought. The items that loaded together included items representing more than one of the three ways of knowing that our framework assumed. However, we saw these results to be consistent with our expectations, inasmuch as the intelligent career framework anticipated the kind of interdependence among knowing-why, knowing-how and knowing-whom items that the factor analysis had found. This led to the first predicament: the conflict between our underlying theory and the restrictions imposed by the formal factor analysis model.

We then proceeded to investigate each of the knowing-why, knowing-how and knowing-whom arenas separately. Now we saw a much clearer picture. Most of the factors derived could be readily interpreted and labeled from visual inspection of their constituent items. The analysis of the knowing-why variables produced twelve factors, using 26 of 35 items, covering such topics as social contribution, innovation, flexibility, concern for family, work atmosphere, and influence over others. The analysis of the knowing-how variables produced ten factors, using 23 of 26 items, covering for example distinctive skills, project activities, working with others, coaching, and strategic thinking. The analysis of knowing-whom variables produced ten factors, using 24 of 26 items, such as feedback, external work relationships, internal company support, industry support and mentoring (**Tables 1, 2 and 3**)³. The opportunity for visual inspection of the factor analysis results also allowed for further reflection on exceptional cases where the suggested links among a factor's variables appeared unclear.

INTERPRETING FACTOR ANALYSIS RESULTS

As already noted, we did not envision a questionnaire as the end result of the research. We understood that forced-choice questionnaires risked «missing or misinterpreting meaning from the respondent's (subjective) frame of reference» (McKeown and Thomas, 1988: 23).

2. One other issue that could not be addressed here is the problem of exploring what we believe to be a dynamic situation through a snapshot—that is data collected at one point in time. We recognize this limitation of our research but view this episode of data gathering as the first in a planned set of follow-up investigations.

3. All data in Tables 1 to 3 are from Parker (1996: 144-148). A normative factor analysis following recommended methodological guidelines was performed on the variables within each of the *knowing-why*, *knowing-how*, and *knowing-whom* categories. Accordingly, factors were extracted for each category to account for at least 70% of the total variance in the results obtained (Stevens, 1986, Tabachnik and Fidell, 1989). The most effective solutions came from 12 factors accounting for 75.7% of variance (knowing-why), 10 factors accounting for 80% of variance (knowing-how) and 10 factors accounting for 83.6% of variance (knowing-whom). A cutoff factor loading of .526 was established in accordance with guidelines for smaller samples provided by Stevens (1986: 344). Complex variables are shown each time they exceed the cutoff factor loading.

Table 1. Factor Analysis Results: Knowing-why

Factors	Loading	Items
1: Societal	.889	making a contribution to society
	.815	doing something useful for others
	.604	being trustworthy at work
	.578	deriving personal meaning from my work
2: Innovation	.838	contributing to innovation at work
	.806	experimenting with new activities and ideas
	.535	being enterprising in my work
	.526	being open to future opportunities
3: Challenge	.763	working in a competitive environment
4: Flexibility	.799	having flexibility to organize my daily schedule
	.660	having flexibility in long term planning of my work
	.635	having autonomy to develop new ideas
	.570	being adaptive to a changing environment
5: Family	.809	sharing work & life responsibilities with my partner
	.784	providing for my family
6: Supportive work atmosphere	.825	working in a supportive atmosphere
	.590	working for a firm that reflects my values
7: Stability	.759	maintaining predictability in my work arrangements
	.737	maintaining stability in my present location
8: Security	.850	seeking & maintaining employment security
9: Approval	.667	gaining external approval through my work
	.600	working in an industry that matters
10: Personal ambition	.834	having employment to suit my lifestyle
	.629	fulfilling personal goals through my work
11: Influence/environment	.788	exerting influence over a changing environment
12: Influence/others	.710	exerting influence over others

Table 2. Factor Analysis Results: Knowing-how

Factors	Loading	Items
1: Skills and knowledge	.906	pursuing and maintaining qualifications specific to my industry
	.809	pursuing and maintaining qualifications specific to my company
	.691	developing skills and knowledge valued by my industry
	.691	pursuing and maintaining qualifications specific to my occupation
2: Distinctive Skills	.897	pursuing and maintaining qualifications that make me distinctive from others
	.895	developing skills and knowledge that make me distinctive from others
3: Learning	.777	gaining training & development that prepares me for my current job
	.727	working with individuals from whom I can learn
	.586	developing skills and knowledge that are valued by my company
4: Working with others	.848	being better able to work with other people
	.738	being able to resolve differences with other people
	.586	being able to bring out the best in other people†
5: Projects	.714	working on projects rather than a continuous job
	.712	doing a job as part of a meaningful project
	.550	performing meaningful projects within my job
6: Leadership	.856	being a better leader
	.668	being open to fresh ideas
7: Coaching	.733	being a better coach to other people
	.562	becoming more responsive to external change
8: Developing new knowledge	.746	becoming better able to work under pressure
	.551	developing generalized rather than specialized skills
9: Strategic thinking	.749	becoming a strategic thinker
	.586	being able to bring out the best in other people†
10: Job situations	.759	working in job situations from which I can learn

† Complex variable included twice.

Our interest was merely exploratory, in that we sought to investigate and learn from the factor analysis data. However, the normative procedures of factor analysis, this time in association with established questionnaire design practices, created further tension. The normative approach was based on a traditional science goal of identifying and distinguishing among separate theoretical dimensions. Accordingly, it suggested the deletion of problem items, reflected in “non-loading” variables excluded from the factors identified, or in single-factor variables that did not fall into any larger pattern (Bryman and Cramer, 1994). Similarly, it suggested dropping “complex variables” that were incorporated into more than one of the factors suggested (Tabachnik and Fidell, 1989).

The suggested deletions did not concur with our underlying concern with the intelligent career, or more broadly with the subjective career. Our theory suggested that people would not necessarily conform to pre-determined dimensions of behavior, but instead would ascribe their own meanings to the items involved. Dropping the problem items would have denied people the opportunity to ascribe meaning to these in the next stage of the research. We sought to develop a card sort that would elicit these meanings. We were therefore reluctant to drop the

Table 3. Factor Analysis Results: Knowing-whom

Factors	Loading	Items
1: Learning through feedback	.737	using relationships to get feedback on my skills and knowledge
	.715	spending time with people from whom I can learn
	.646	identifying and reaching people from whom I can learn
	.644	using relationships to gain feedback on my abilities
	.617	developing and maintaining relationships with others in my occupation
	.608	using relationships to gain feedback on my performance
2: Gaining support	.590	using relationships to acquire new information†
	.855	getting to know people who will advance my reputation
	.836	developing relationships to access new information
	.618	gaining support from people outside my company
3: Mentoring	.586	getting to know people who can act as mentors for me
	.550	using relationships to acquire new information†
	.868	spending time with people who can learn from me
4: Company specific relationships	.820	giving access to people who can learn from me
	.859	gaining support from people inside my company
5: External relationships	.684	developing relationships with people inside my company
	.751	developing and maintaining relationships with family
	.593	developing and maintaining relationships with outside my company
6: Support/potential	.532	developing and maintaining relationships with competitors
	.823	developing and maintaining relationships to provide social support
7: Work relationships	.550	using relationships to gain feedback on my potential
	.810	developing and maintaining relationships with others in my industry
8: Suppliers	.793	developing and maintaining relationships with suppliers
9: Internal support	.854	giving support to people inside my industry
10: Working in teams	.879	working in teams to learn

† Complex variable included twice.

problem items, especially in cases where we recalled the enthusiasm with which certain focus group participants had spoken about the issues involved. For example, a normative response to factor analysis would have been to drop items such as the single-factor variable that did not meet the cutoff factor loading “I want to work in a competitive environment” (knowing-why), the non-loading variable “I seek training and development beyond my current job” (knowing-how), and the complex variable “I develop and maintain relationships with previous employers” (knowing-whom). Yet in all three cases we had evidence that these items held distinct importance for some of the research participants.

A different kind of problem occurred when factor analysis results suggested that we merge items into a single construct when our theory suggested otherwise. For example, the factor analysis merged the three (knowing-how) items “I pursue skills and knowledge specific to my company,” “I pursue skills and knowledge specific to my occupation,” and “I pursue skills and knowledge specific to my industry.” However, from the intelligent career standpoint company, occupation and industry were three distinct contexts that could attract distinct kinds of career investments (DeFillippi and Arthur, 1994). (A case in point would be the mobile high-technology worker seeking cutting-edge occupational experience rather than particular company or industry experience.) We found the opportunity provided by factor analysis to consider data such as this to be genuinely helpful. We deliberated over the observation that only a minority of questionnaire respondents—all of them still MBA students—made the distinctions between three kinds of career investment that our theory suggested. We reflected back on the previous focus group discussions we had heard. We recalled the strategies that experienced people had described to seek out transferable knowledge and preserve employability. We concluded that a minority of questionnaire respondents could be harbingers of change, proponents of new forms of career whose differences might be highlighted rather than neglected. We therefore chose in this instance not to proceed as factor analysis would suggest, that is we chose not to combine the items indicated⁴.

4. This does not mean that our sample was inappropriate. It does mean, as suggested earlier, that different people had different meanings for their card selections; differences that were washed out using the traditional factor analytic techniques.

Q-SORT METHODOLOGY

The goal of eliciting data about the subjective side of people’s careers led us to consider the use of the Q-sort methodology (Stephenson, 1953). (The qualifier “Q” is meant to distinguish the person-centered methodology from the population-centered “R-methodology” where R indicates regression analysis.) Q-methodology involves a process similar to the one we anticipated when our own card sort would be complete. People are asked to select and rank cards based on the underlying meaning and importance that the card sort items hold for the person. The method has been described as serving «the scientific study of human subjectivity», that is, of «a person’s communication of his or her point of view» (McKeown and Thomas, 1988: 12). We were further intrigued by Q-methodology because of its proponents’ discomfort with factor analysis. For example, Stephenson’s (1953: 3) original work

argued that factor analysis «assumes that everyone has the same psychological attribute in some degree,» and that the factor analysts' pride in "pure objectivity" had interfered with the possibilities for new theory development.

What we found was that the Q-sort originator's enthusiasm for exploring the person's subjective perspective had not been universally sustained. In particular, one prominent branch of Q-methodology has departed from Stephenson's concern with the subjective self. This branch, underlying the development of the California Psychological Inventory, firmly locates the psychoanalyst or counselor as "judge" of the person's responses (Block, 1978). The associated Q-sort technique is described to provide «a convenient means of *objectifying* the impressions and personality formulations of observers» (Block, 1978: 4, italics added), while neglecting participants' own interpretations. According to this technique, a person's subjective view is «simply a curiosity piece and not a datum of science» (Block, 1978: 35). This is clearly inconsistent with our own focus on the subjective career, and thereby on the person as the "judge" of his or her own career behavior.

SCORING CARD SORT RESULTS

Q-methodology also provided an established method for weighting the importance of successive card sort selections, assuming a two-tailed normal statistical distribution, to provide summary group data (Carr, 1992). This was important to us, since at the time we were concerned to develop a methodology to capture inter-subjective data—namely, shared meanings among people whose careers exhibited common characteristics that we sought to study⁵. The basic idea, inspired by recent developments on focus group thinking (Krueger and King, 1998), was to share the most important card sort selections with a focus group of representative participants. We needed a consistent way of determining not only the frequency of selection but also the relative importance, based on people's individual rankings, of the card sort items, a problem with which the proponents of Q-methodology had already grappled.

However, we could not apply the Q-methodology approach directly. Its assumption of a two-tailed normal distribution derives from a long-standing recommendation to develop a "balanced design" of cards, namely equal numbers of opposite kinds of statements (Stephenson, 1953). For example this would involve including an equal number of statements about job mobility as about job stability, it would also involve an equal number of statements about working alone or working in collaboration. In turn, the research participant would be asked to provide a set of cards with equal numbers reflecting both positive and negative responses, to cover both ends of the underlying dimensions being explored.

By this stage of the project we had moved beyond our original sample and developed the card sort to allow respondents to choose from a total of 111 items. The card sort required up to 45 minutes to complete, and we asked for only positive responses, that is to select the items

5. We worked on this methodology along with Kerr Inkson during 1997, and first presented it in early 1998. A paper based on that presentation has since been published (Parker and Arthur, 2000), and a PhD dissertation extending the methodology has since been completed (Parker, 2000).

that were most descriptive of a person's present career behavior. We anticipated a practical problem in extending the time to complete the card sort to incorporate the balanced set approach. This however was not the main reason for our decision. We wanted to focus on the attraction the person felt toward alternative opportunities for determining her or his career progression. To put it another way, our focus was on the investments people were making in their careers rather than the investments they were not making. Moreover, we saw our card sort bringing a social psychological focus, concerned with the interplay, or mutual attraction, between people and the kind of career situations they sought out. The idea of a balanced set didn't appeal to us.

In the circumstances, we chose to modify the traditional two-tailed weighting system that had been derived for the balanced set approach. We used the same assumption of a normal distribution, and we predicted the size of our card decks as if a full balanced set of items had been included. We then came up with a weighting system based on that predicted size. We saw our modification as respectful of both the social psychological approach we adopted and previous Q-sort traditions. However, we felt vulnerable to the reaction we might receive from established Q-sort users. This, we feared, would mirror the same kind of conventional thinking we had found in factor analysis, and press us to assume a series of separate (and therefore two-tailed) dimensions⁶.

6. There was a concern that the items were derived from a local and perhaps idiosyncratic MBA population, and therefore of limited applicability to a larger population of workers. An exercise was conducted to explore (then) recent sources about the changing nature of work and careers, focusing on Harvard MBAs (Kotter, 1995), middle managers (Heckscher, 1995), the broader restructuring of work (Bridges, 1994) and emerging contributions to the exploration of boundaryless careers (Arthur and Rousseau, 1996b). There was also an opportunity to inspect reported motivations behind 200 job situations explored in a concurrent national study (Inkson, Pringle and Arthur, 1996). As a result the items retained after factor analysis were refined and additional items were added, culminating in 40, 36 and 35 items under each of the knowing-why; knowing-how and knowing-whom headings respectively.

GATHERING INTER-SUBJECTIVE DATA

One of our hopes for the card sort was that it would help in the gathering of inter-subjective data, namely shared understanding «occurring between or among (or accessible to) two or more separate subjects or conscious minds» (Dreier, 1996: 107). For this purpose, we were trying out a methodology, initially with management consultants and sexual abuse counselors, based on aggregate group data. The approach involved identifying the most important card sort items across the group as a whole, and then feeding this information back to a focus group of the workers in question. In turn, the workers would be asked to discuss and interpret the meaning behind the items. The methodology would have the advantage over a straightforward focus group in that the act of administering the card sort captured critical subjective career data, and in turn obliged the focus group to concentrate on that in their discussion.

We determined the most important card sort items based on which cards carried the highest average weight. However, we also gave the focus groups information about the frequency with which the same cards were chosen. Both data points appeared to be useful. The weights appeared to help the groups' allocation of time, and the relative attention they paid to each item that they were asked to discuss. The frequencies gave a clearer sense of how often the selected cards were chosen among the workers in question. The focus groups themselves were characterized by a high level of energy among their participants, so that people persisted in the search for shared interpretations.

However, we now came upon an obstacle from an unexpected quarter. A sympathetic reviewer of the work nevertheless recommended that we disregard the one-tailed weighting system that we had developed. The recommendation appeared to reflect the reviewer's own identification with qualitative research as a separate and distinct area of inquiry from quantitative research. The recommendation also seemed to reflect a political argument: Why invite the gatekeepers of quantitative social science methodology to criticize the research on their own terms? Why not simply exclude those gatekeepers from the conversation? Why not just report the most frequently selected items? We seemed caught in the middle of an argument between traditional quantitative social science and its qualitative opponent. However, we did not see the logic in joining either side of the argument to the exclusion of the other.

LINKING QUANTITATIVE AND QUALITATIVE INQUIRY

For the reasons described above, we had now adapted traditional science methods—spanning both factor analysis and Q-methodology—to our own purposes. Along the way we discovered that we were not alone in our discomfort with what “normal” social science seemed to be requiring of us; we encountered support for our approach in a well-regarded reference source on traditional social science techniques. Specifically, Nunnally and Bernstein (1994: 330) suggest that factor analysis «is useful only to the extent that it aids in the development of principles of human behavior.» They also suggest that «there has been a tendency to overdo the mathematical requirements of factor analysis» resulting in «a bad case of “the tail wagging the dog.”» The authors propose that the experimenter should simply ask «How much will this help in my program of research?» (Nunnally and Bernstein, 1994: 330). However, the established practice that we had encountered over the course of our study seemed very much out of sympathy with these authors' recommendations.

By this time we had also field-tested our preliminary version of the card sort with over 350 clients, either individually or in pilot workshops (where clients worked together, under supervision, in discussing their card sort selections) (Parker, 1997). The feedback we got from that testing was encouraging. Most respondents reported that the card sort helped them bring to the surface and express their most pressing career concerns, and that the range of cards was adequate for that purpose. The subjective career was evident in some of the sharp distinctions in the way people spoke about the same card sort item. The three ways of knowing made intuitive sense for people in the way that they reflected on their career past and anticipated the future. They could see, for example, how the impact and interplay of their (knowing-why) enthusiasm and (knowing-whom) experiences of mentoring modified their subsequent (knowing-how) career investments, and how these in turn played back on earlier investments. Our field experience led us to ask if we might find greater support for our work outside the domain of traditional social science.

FROM TRADITIONAL SCIENCE TO "NEW SCIENCE"

The difficulties described above drew us toward alternative social science arguments that would better support our work and through it the elicitation of the subjective side of the career on which we were focused. At this juncture three sets of arguments appealed to us. One was to join in with the critics of traditional social science methodologies, another was to join the proponents of qualitative research, while a third was to adopt "new science," much like Wheatley (1992), as a guiding metaphor.

JOIN THE CRITICS

We were not alone in feeling the constraints of traditional science guidelines. Earlier proponents of the subjective career had been harshly criticized by Wilensky (1961: 523) who urged that we «define career in structural terms [as] a succession of related jobs, arranged in a hierarchy of prestige, through which persons move in an ordered (more-or-less) predictable sequence.» As a result even proponents of the subjective career were cautious about its place in the research agenda, conceding «problems in terms of validity and reliability of measurement» in the data that could be collected (Stebbins, 1970: 42). However, the price for such caution may be considerable. Sutton and Staw (1995: 380) suggest it has given rise to a community of social science researchers who are «primarily trained in data collection techniques and the latest analytical tools, not the nuances of theory building.» They add that those researchers' inclinations are to fit concepts and arguments around «what has been measured and discovered [instead of appreciating] that major contributions can be made when data are more illustrative than definitive.» (Sutton and Staw, 1995: 380).

Whatever the leanings of other researchers, our own research interests resonated with Weick's (1989: 524) argument that the «contribution of social science does not lie in validated knowledge, but rather in the suggestion of relationships and connections that had previously not been suspected, relationships that change actions and perspectives.» As our research project was underway these sentiments were echoed by Turner (1997: xiv) who argued that individual freedom to act preceded the discovery of new meanings, which in turn preceded further actions. Therefore, the «mathematical science of statistics (...) the most sophisticated and widely used tool of social science [gave] a severely limited picture of social systems» (Turner, 1997: xxvii).

We drew encouragement from these arguments, but their influence over the kind of career research being sanctioned appeared limited. The great majority of published research on careers still emphasized objective career rather subjective career phenomena (Arthur and Rousseau, 1996a). Meanwhile, the work of Turner (1997) and others suggested different possibilities.

STAY QUALITATIVE

As we have already noted, the criticisms of the traditional social science methods coincided with a trend towards alternative qualitative research. Enthusiasts for this kind of research were increasingly challenging the traditional science view that interpretive methods were «unreliable, impressionistic and non-objective» (Denzin and Lincoln, 1994: 5). One encouraging strand of qualitative research came from the field of participative inquiry. According to its originator, this also stands «in marked contrast to orthodox social research» (Reason, 1994: 332) in its emphasis on the subjective self. Participative inquiry, like the concept of the intelligent career, envisions the interplay of people's subjective and objective worlds evolving over time, and sees this evolution occurring through «the reflective action of persons and communities» (Reason, 1994: 333). To constrain people's opportunities for reflection, based on the strictures of traditional social science, therefore seemed counterproductive. To paraphrase Reason (1994: 325) it would have excluded data that may have been most important to the thinking and interpretation of the career actors themselves.

The voices of qualitative social science researchers frequently traced back to the Chicago school of sociology, from where much of the theory underlying the subjective career first originated (Barley, 1989). Other voices traced back to overlapping ideas of Berger and Luckman (1966) on the social construction of reality, or of Bateson (1972) on a subjectively-constituted world. Yet other voices spoke for the importance of personal choice and agency in economic activity (Ellig and Thatchenkery, 1996). The common factor was one of the subjective self as a critical contributor to career behavior and its outcomes for both self and society. All of these voices appeared to be congruent with the concept of the intelligent career, but incongruent with the orthodoxy of traditional science that would restrict how people might describe their careers.

ADOPT THE "NEW SCIENCE" METAPHOR

Our discomfort with traditional social science, and our search for support for our research interests drew us toward "new science," what Wheatley (1992: ix) has called the territory of «hypotheses and discoveries in biology, chemistry and physics that challenge us to reshape our fundamental world view.» New science thinking directly challenges the suitability of traditional reductionist methodologies that once dominated the physical sciences (Gleick, 1987). By analogy, it also challenges the suitability of the traditional methodologies used in the social sciences (Mathews, White, and Long, 1999). New science supports a primary focus on the whole rather than the parts, and thereby a systems focus, accommodating the dynamic properties that have been described as «a recurring preoccupation of social theory over the centuries» (Cohen, 1999: 374). As a result, certain social science writers are now adopting the language of this new (physical) science as an «intriguing [new] way to think about the world» (Tettenbaum, 1998: 32).

Most applications of new science we found used its ideas metaphorically, to suggest new descriptions of how the social world might function (Kiel and Elliott, 1996; Church, 1999). Metaphors play a key role in shaping our conception of phenomena through their «formative impact on language, on the construction and establishment of meaning, and on the development of theory and knowledge» (Morgan, 1993: 277). For example, social system elements have been viewed to exhibit the new science principle of interdependence, meaning that people (and so careers) mutually affect each other instead of being tied to a one-way cause-effect sequence (Goerner, 1995). Variety and disorder, in contrast to linear relationships, have been seen as «a feature of the social life world itself rather than of bad behavior [or] imperfect social controls...» (Young, 1996: 220). The elements of the social world have also be described to be self-organizing, that is to create their own order from “human agency,” namely acting on our own behalves, as «the grounding point for all human and human-impacted activity» (Loye, 1995: 26). The generation of fresh energy is seen to underlie the process through which «humans individually and collectively try to bring the world into their orbit of control» (Baker, 1993: 138-139).

We found encouragement in the words of the previously cited writers. We were also encouraged by their shared appetite for alternative methodologies that would be concerned, as one authorship team put it, to «seek out and understand the nonlinear dimensions of social life lying just below the surface of seemingly staid, equilibrated institutions and groups» (Harvey and Reed, 1996: 321). What troubled us now was the choice that faced us. It appeared largely as a direct choice between quantitative and qualitative methodologies. In taking the qualitative path, we could usefully adopt “new science” ideas in a metaphorical sense to describe the phenomena under study. However, that path would stop short of tackling the principles on which traditional social science was based. We wanted to do more in confronting, rather than (as we saw it) circumnavigating those principles.

THE PROPERTIES OF COMPLEX SOCIAL SYSTEMS

It is clear—as this volume attests—that we are engaged in a much larger debate than we can resolve here. Social science research is only at the beginning of a protracted and uncertain journey into the application of “new science” thinking (Harvey and Reed, 1996, Lewin, 1999).

Until that journey has progressed, we are largely stuck with the social science research tools we have. However, our experience suggests that misunderstandings can be reduced, and more diverse research experiments encouraged, if we can move toward a shared understanding of the principles underlying “new (social) science” research endeavors. In this regard we have recently been introduced to the work of Cilliers (1998), a philosopher whose careful treatment of one branch of “new science,” complexity theory, invites attention. Cilliers

stands back from the tangle of recent engagement with new science ideas to suggest a set of ten properties, drawn from complexity theory, which he sees underlying what he calls the «complex social systems» of social and economic life (Cilliers, 1998: 3-7, 119-121). We found his work a helpful reference point for the sharpening of our own ideas, as well as for its engagement with post-modernism, a popular inspiration for the proponents of alternative research methods (Clegg, Hardy and Nord, 1996). We were also encouraged by early reactions to Cilliers' work, including complimentary words from an eminent philosopher of science describing it as «cogently argued, important and original» and another philosopher's review that it exhibited «a considerable command of both post-modernism and the scientific fields under discussion»⁷.

We found a modified set of seven of the properties Cilliers describes to be particularly relevant to the difficulties we have reported here. We describe those seven properties below, and briefly relate each of them to the problems we encountered.

THE ELEMENT IS THE PERSON

The fundamental element in complex social systems is the person. Moreover, a «large number of elements [such as] the economically active people in a country» (Cilliers, 1998: 3, 6) are necessary for a system to be understood in complex systems terms. Also, with a large number of elements (and therefore of careers), conventional analytic methods of understanding become increasingly impractical.

Part of our struggle with the normative use of factor analysis was its reductionist approach to understanding people, rather than accommodating or celebrating individual uniqueness as the «intelligent career» framework suggests. Moreover, if we shift for a moment from social systems to the person as a system, we can find further support in Cillier's work. In his view of the human brain and its problem-solving capacities, Cilliers (1998: 26-35) describes a process based on «connectionism» and interdependence among the brain's components. The description aligns much more comfortably with our idea of interplay among the three «ways of knowing» than it does with the search of traditional factor analysis for separate, and usually orthogonal, dimensions.

PEOPLE INTERACT DYNAMICALLY

People are engaged in constant interaction. Interactions are «rich» in the sense that one person is typically influenced by a number of other people. Interactions provide for the transfer of information, as occurs among economic agents—that is, as occurs among people with overlapping career interests.

In our conception of the intelligent career, we saw dynamic interaction occurring through a person's knowing-whom network of relationships. We also believe that information flowing through this network of relationships would affect a person's knowing-how career-relevant skills and knowing-why career-relevant motivation. Our framework once more seems compatible with a complex social systems approach, but

7. The first review comes from Mary Hesse, widely respected author of *Revolutions and Reconstructions in Philosophy of Science* and appears on the Cilliers book jacket. The second review comes from Spurrett (1999).

incompatible with the formal structure of factor analysis. For others that were presently established in the research community, the evidence of interdependence among our proposed dimensions was seen as undermining our theoretical position.

INTERACTIONS ARE NON-LINEAR

Non-linear interactions are a precondition for complex social systems, and in turn for self-organization. This means that elements cannot be reliably combined into a smaller number of categories, as they usually are combined in traditional analytic approaches. One consequence of nonlinear interactions is that small causes (that is, taking a course because it fit into one's schedule of having all courses on Monday and Tuesday, which resulted in falling in love with a subject area, which resulted in declaring a major, which in turn resulted in a career in that domain) can have large effects, and vice-versa.

Here, we simply repeat a point already made. Our approach was not concerned with finding linear associations, for either the individual person (as career actor engaging through the three ways of knowing) or for the social system (as it was shaped through peoples' interdependent career behaviors). Our approach therefore tried to make more selective use of the available methodologies of traditional social science, and in particular more selective use of factor analysis. In doing so we sought to avoid any presumption of linear relationships.

INTERACTIONS ARE SHORT-RANGED

People usually interact with their immediate neighbors through local clusters. However, this does not preclude either the people or their host clusters from producing large, and non-linear, system-wide effects.

Here we are particularly grateful for Cilliers' insight. We mentioned earlier that part of our intended research project was to develop a methodology to elicit inter-subjective data—that is, shared meanings stemming from what Cilliers calls local clusters. We used focus groups to draw out these meanings, and through them an appreciation of the cluster's mutual engagement (Wenger, 1998) with the larger career systems with which they were engaged. Our choice to weight and report aggregated card sort results to focus group members appeared helpful to the members' conversations, and consistent with Cilliers' view about the extent of local cluster interactions. In other words, Cilliers' view affirms our weighting system approach, rather than suggesting we avoid it for fear of any academic gatekeeper's objections.

THERE ARE LOOPS IN THE INTERCONNECTIONS

Feedback loops are essential to the survival of complex social systems. Both positive and negative forms of feedback are necessary. These lead to people's reflection and self-transformation (and in turn career transformation).

At both the intra-personal level (among the three ways of knowing) and the inter-personal level (among career actors), our approach accom-

modated the basic idea of feedback loops. However, our approach fell foul of the assumptions of linear correlation that underlie factor analysis and other established quantitative social science methods. Despite the widespread appreciation of feedback loops in the physical sciences, they have not been widely recognized in what are seen as the traditional “objective” methodologies of social science (Kerlinger, 1986)⁸. Thus, although we found traditional science methods useful and adaptable to our purpose, we were discouraged from using them by representatives of both quantitative and qualitative methodologies.

COMPLEX SYSTEMS ARE OPEN SYSTEMS

Complex systems are usually associated with living things, and interact with other complex systems. Conceptions of “closed” company or occupational or national career systems are framed by their observers, rather than characteristic of the systems themselves.

Our intelligent career approach, and its extension of the underlying philosophy that people are mobile and—to paraphrase Quinn (1992: 151)—«don’t have to work for any single company» respect this view. However, the tradition of career theory reflects a pattern of what may be characterized as “closed system” approaches, based on assumptions of people staying in the occupations or organizations in which they currently work. We can only resort to conjecture along the lines of the previously cited work of Sutton and Staw (1995), and suggest this may occur because of the way social scientists have been trained. It may be a regrettable secondary effect that this training interferes with the acceptance of alternative research designs.

COMPLEX SYSTEMS OPERATE UNDER CONDITIONS FAR FROM EQUILIBRIUM

Social systems require a constant flow of energy to survive and evolve. The dynamics of supply and demand, including labor market dynamics affecting careers, prevent any prospect of equilibrium. From a complex systems perspective, equilibrium is «another word for death» (Cilliers, 1998: 4).

Once more, this property concurs with the underlying conception of the adaptive, motivation-driven, knowledge-seeking and relationship-centered conception of the intelligent career that underlay our research project. It differs from the assumption we encountered that underpins traditional methodologies, concerning both the psychology of the person (possessing relatively static, orthogonal attributes) and the environment (the supposedly enduring host company or occupational or economy-wide employment system) in which the person’s career played out.

In sum, Cilliers provides encouragement for the intelligent career view at the same time as he challenges the assumptions of the traditional social science principles we faced in our research project. The question emerges “What is the point of engaging with social science methodologies whose assumptions are inconsistent with the research being undertaken?” Our answer—and emphatically so given the dearth of present alternatives—is to be more selective about the way

8. Recent developments in longitudinal analysis and structural equation modeling are beginning to find their way into our fields.

the methodologies are applied. To draw an analogy from the physical sciences, Einstein's theory of relativity may have superseded Newton's laws, but Newtonian tools still serve much research very well.

In our experience, we found the same for the tools of traditional social science. We were grateful to have access to them, and found it helpful to adapt them to our research agenda. It was in the assumptions of the academic keepers of the tools where our problems lay. We submit that, in the light of complexity theory and other "new science" advances, these assumptions are becoming increasingly inappropriate. They are too often the tail that wags the dog.

CONCLUSION

We have described how the "discipline" of traditional science raised obstacles to our research program. We found exploratory factor analysis was useful. However, the mainstream position on the use of factor analysis was problematic. It was inconsistent with the interdependence among the three ways of knowing that our underlying (intelligent career) theory predicted. We also found that the recommended way of dealing with problem items, notably "non-loading" and complex factors, was insensitive to our concern to represent and investigate the subjective career, a cornerstone of our theoretical approach. We found Q-methodology to be helpful. However, we were troubled by a prominent development that sought to "objectify" the interpretation of results, and by a "two-tailed" weighting system insensitive to our purpose. We identified with a range of arguments from qualitative methodologies, and found those beneficial in interpreting our use of traditional social science techniques. However, the arguments included a suggestion to avoid the techniques of traditional social science, rather than adapt them in the way we had done.

Our problems stemmed from long-standing assumptions of traditional quantitative social science, in particular regarding equilibrium, linear relationships and objectivity of the findings reported. In contrast, we found the ideas of "new science" more supportive. At least at a metaphorical level, non-linear systems, interdependence, self-organizing and other related concepts seemed more consistent with the assumptions underlying the intelligent career framework. We turned to a philosophical interpretation of one branch of "new science," complexity theory (Cilliers, 1998), and found seven properties of complex social systems relevant to our work. These properties affirmed our investment in the research undertaken, and in the selective use of traditional social science methodologies we had made.

To close, we submit that, as with physical science, the methodologies developed from the ideas of traditional social science can still be useful. However, we submit that this use ought not to be constrained by what seem to be increasingly questionable theoretical assumptions. Careers research can still use established methodologies to explore alternative "new science" principles. We hope it will be allowed to do so.

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