113.21, respectively; $p < .005$], but that of task was not [F (2, 51) = 1.37]. (In a similar vein, Roberts has employed a one-way ANOVA with repeated measures, to determine whether standing had an effect on sleep latency.)

A second data-analytic approach is to employ a within-subject multiple-regression model (Lorch & Myers 1990), as has been previously implemented for the individual assessment of structural brain asymmetries (Glicksohn & Myslobodsky 1993) and for studying profiles of line-bisection performance (Soroker et al. 1994). Both hemisphere and session were dummy-coded, and task was defined by means of two dummy variables, using the eyes-closed baseline condition as a suitable reference. The regression was significant [F (5, 54) = 47.76, MSE = 0.005, $p < .0001$, R2 = .82], with significant contributions for epoch size ($b = -0.10$, $p < .005$), hemisphere (b = −0.19, $p < .0001$) and session (b = −0.18, $p < .0001$), and no significant contributions of either dummy variable indexing task. These results essentially replicate the previous findings.

Roberts might well consider more extensively analyzing his n = 1 data base, using the methods described above.

Self-experimentation and self-management: Allies in combination therapies

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Abstract: Self-experimentation is a valuable companion to self-management in the benefit of pharmaco-cognitive-behavior combination therapies. However, data on individuals participating as active therapeutic agents are sparse. Smoking cessation therapy is an example. Roberts' self-experimentation suggests trying more diversity in research to generate new ideas. This may inform current approaches to the cessation of smoking.

Self-management skills – usually referred to as self-regulation or self-control – are valuable tools relevant to nearly any setting where independence from medical, therapeutic, or teaching agents is a desirable long-term goal. Self-management can involve patients as decision-makers in the long-term outcomes of their treatment (see Grote [1997] for combination therapies of pharmaco-cognitive-behavioral dimensions).

Self-management skills emphasize prevention and, importantly, relapse prevention. Treatments which involve individuals as self-managing decision-makers, and therefore, as therapeutic agents, may empirically turn out to work better than those which do not do so. Given these premises, modern training of medical professionals and therapists seems to mandate instructor skills for teaching self-management, and to suggest that instructors practice self-study. Anecdotes, data, and conceptualizations in the history of science indicate that methodological self-study can contribute important outcomes to medical and other sciences (e.g., Altman 1987/1998; Neuringer 1984).

Where there is self-management, self-experimentation typically is not far away. Select academic programs started teaching students long ago the techniques of studying their own conduct or self-perception using scientific method (cf. Burkett 1987; Hoch 1987; Jacobs 1990). (For example: Jacobs exemplifies studying the effects of smoking, with self-experimentation, Burkett exemplifies studying ways to quit the habit, with self-management, and Hoch exemplifies combining both, studying effects and implementing cessation management.)

Self-experimentation motivates individuals' curiosity to *understand* cause-effect relationships resulting from variables that they implement systematically, without necessarily wanting to change their lifestyle. Self-management teaches individuals to change some aspect of their lifestyle by systematically changing relevant variables, usually packages of variables, without necessarily wanting to understand or analyze which variable contributes to the outcome. A combination of both approaches, self-experimentation and self-management, motivates individuals to understand the systematic changes in conditions under which they may be able to manage realistic changes in their lifestyle. Thus, Jacobs (1990) is interested in the effects of smoking on the human heart. He does not tell us whether he is interested in self-managing smoking cessation as a result of the findings of his self-experimentation. Burkett (1987) demonstrates that she manages to stop smoking. She does not convey whether she wanted, or needed to understand which component of her package contributed to her success. Hoch (1987) finds that he can quit smoking – to change his lifestyle – and can gradually reduce his criterion, nicotine content, while he counts monies not spent on cigarettes. Carrying Hoch a step further with self-experimentation would have systematically reversed change in nicotine level and money counting. But in clinical practice, reversals for the sake of scientific curiosity can outweigh short-term cost versus long-term benefit.[1]

For the point of Roberts' self-investigations, in each of the three examples on smoking cessation offered in this commentary, some degree of control was in the hands of the individuals who studied themselves, as well as some degree of ingenuity. Therapies on smoking cessation may benefit from the three types of self-exploration to confer some degree of control to participating individuals, and to come up with new ideas for therapy.

Smoking appears to be one of the hardest habits to kick, particularly for individuals with a history of use of other addictive substances: Effective therapies are hard to find: Recidivism is typically considerably higher than maintenance of abstinence. Choosing the best combination remains controversial (Petry & Simcic 2002; Shoptaw et al. 2002). The present comment proposes that the controversy may persist: Therapies may want to try to include smokers themselves as therapeutic agents and as decision-makers in their combination of pharmacological, physiological, and behavioral components. During self-experimentation, interesting findings may surface; at a self-management, level, participants may experience control over their own quality of life changes. Traditionally, individuals receiving therapy are not engaged as therapeutic agents, perhaps on account of the reluctance to accept any data from self-studies as a valid method. Roberts (1998) mentions this reluctance, and in fact likens it to the reluctance many have in accepting smoking as a hazard, despite evidence to the contrary (e.g., Centers for Disease Control [CDC] 1997).

Roberts' effective use of self-experimentation, his conceptual conclusions combined with traditional experimentation, may teach a valuable lesson for smoking cessation research: The persisting controversy about effective components of combination therapies may incite seasoned grant researchers, or any practitioner with an inquisitive experimental inclination, interested in research-based therapy, to invite individuals or groups of individuals to collect self-observation data and to brainstorm their observations and data in individual or in group settings, suggesting self-management, and spurring self-experimentation. Surprising new ideas may spring from such scientific adventure! Visual analysis of basic data designs for self-experimentation and for self-management can easily be taught, as results from self-experimentation replicated across individuals suggest (Grote 2003); accessible visual analysis may enhance motivation or self-analysis.

Roberts' self-studies demonstrate that diversity in scientific method and conceptualizations may promote "selection" for unusual results, and for a richer fabric of results, as confirming or disconfirming traditional techniques by unusual scientific techniques. The history of science supports Roberts' contention that observing diverse behavior *with diverse methods* is better than observing behavior of a limited group and with limited methods. Metaphorically speaking, based on evolutionary conceptions the strongest (data-based and outcome-effective) conclusions inform each other by way of different approaches, and may spur improved approaches. The criteria, based on diversity of approaches, become more stringent – similar to those operating in technology (Grote 1999).

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I enjoyed seeing the visual presentations of Roberts' findings, in addition to the statistical formulae. The latter are useful for some scientific audiences, but esoteric to most individuals whom we might want to interest in data-based self-experimentation – or self-management in therapeutic combination technologies. Visual approaches are closer to common sense (Grote 2003). The presentation of Roberts' visual analyses would benefit if the scales of graphs were equal in units or maxima, where relevant, or if it were signaled to the reader when they are not and why they need not be; conventional techniques are available to this effect (see, e.g., Figs. 21, 24, and 30).

A tabular overview of the 10 years of self-experimentation in future reports by Roberts might help readers to catch up with him over several pages of text and references: For instance, it would help if his10 years of self-experimentation were organized by concurrent or subsequent data collections, represented by different figures and sections, and by categorizing what worked or did not work, compared to what did or did not confirm conventional beliefs and traditional scientific outcomes. Roberts' Table 2 in the target article serves as a nice example of this.

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NOTE

1. Coincidentally, I happened to be correcting the copyedited version of the present commentary while on a flight back from Washington D.C. where, across the aisle from me, sat an academic colleague who had just managed to lose 50 lbs of weight in a brief time span, in the course of a therapy that he considered more effective and successful than the typical recidivism rates we hear about from weight and smoking cessation therapies. Upon my querying my colleague about his role in the successful outcome, data collection process, and analysis, he stated that he was not interested in an analysis of the variables which led to his success and that of 30% of his cohorts (though he did participate in data collection, and he found the daily feedback from his balance an important incentive). Perhaps my colleague provides an example of the degree to which "self-control" is separate from "self-management" (Grote 1997), and therefore from self-experimentation in Roberts' sense.

Self-experimentation chronomics for health surveillance and science; also transdisciplinary civic duty?

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Abstract: Self-surveillance and self-experimentation are of concern to everyone interested in finding out the factors that increase one's risk of stroke from <8% to nearly 100%; one also thereby contributes to transdisciplinary science.

Why chronomics? Whenever there are inter-individual differences in response, clinical trials on groups that do not consider such differences cannot solve what only the individual can do cost-effectively, such as finding out whether one's blood pressure (BP) responds to an increase in sodium intake with a rise, with no change, or with a decrease. Eventually, special institutions may be designed for the support of each individual's chronomics, that is, for the transdisciplinary monitoring of *chronomes* (time structures; from *chronos,* time, and *nomos,* rule) of biological variables, and for their interpretation, archivization, demographic analysis, and follow-up for outcomes. Recently, a particular individual's record sent to an international project on "The Biosphere and the Cosmos" (BIOCOS; corne001@umn.edu), coded to guard confidentiality, has become part of a promptly accessible database for both personal, individual needs and society's requirements. What was started by individuals and small groups as a self-experimentation in chronobiology, is currently available as a service by BIOCOS and could become a public system of planned surveillance and archivization of a person's "womb to tomb" chronomes (Halberg et al. 2001; 2003)[2]. Alterations of a standard deviation of heart rate (HR) and/or of a BP circadian rhythm's amplitude or acrophase can signal risk elevations, prompting countermeasures. Intervention prompted by risk elevation rather than by overt disease has been called prehabilitation.

Automatic ambulatory monitoring equipment is available at a 85% discount through the BIOCOS system; this project's Minnesota center analyzes, manages, and exploits all the available information, thus rewarding all participants and not just the individual providing the data. BP and HR are monitored automatically, ambulatorily, without vexing electrodes; or they can be manually self-measured around the clock and calendar, for long spans. Some opinion-leading physician-scientists suffering from hypertension, including a head of the clinical center at NIH, self-monitored their condition for decades from diagnosis to the fatal event. For those who have an over-the-threshold BP variability or an under-the-threshold HR variability, the risk of strokes and other cripplers rises from less than 8% to about 40%, even when the 24-hour average BP is acceptable. When both outlying variabilities coexist, the stroke risk is 80%. The risk is very high also with a further coexisting over-the-threshold difference between systolic and diastolic BP (pulse pressure), as shown in Figure 1. Excessive BP variability can be reduced and its excess eliminated, sometimes by rescheduling the timing of a drug without altering the dose (Halberg et al. 2003).

Prehabilitation. Public concern for clean air and water and clean, safe streets can be matched by striving for a safe circulation, to save the cost of rehabilitation by self-experimentation. Self-surveillance, initiated and implemented by an educated public, benefits health and science and is cost- and litigation-free. Preventive health maintenance – prehabilitation that is neither a commodity for sale nor a birthright – is an obligation to oneself and to society. A governmental cartographic institution for chronomics by prehabilitation may eventually reduce the need for agencies and resources instituted by law for rehabilitation.

Science. With goals in health care, having one agency serving both chronomics and the individuals it involves could make a transdisciplinary contribution to science; for instance, by making physiological recordings to match routine monitoring in atmospheric and solar-terrestrial physics, which has been systematically going on for centuries on Earth, and for decades via satellites. Newest is a wobbly average near ~1.3-year component in around-the-clock records for up to 35 years in the BP and HR of human "test pilots," nearly matching Richardson's also-wobbly ~1.3-year variation in the solar wind, recorded via satellites (Richardson et al. 1994). That a certain religious motivation shows an approximately 21-year cycle with latitude-dependent characteristics (Starbuck et al. 2002), with a period length found not only in homicide and war but also in Hale's bipolarity cycle of sunspots, should prompt self-experimentation in order to clarify the underlying mechanisms. Time-varying amplitude-unweighed phase synchronization, as a method developed by one of us (Schack), reveals the novel phenomenon of transient multifrequency phase synchronization between a biomedical series (daily incidence of mortality from myocardial infarction) and a host of aligned putatively influential physical variables. This new time-varying multifrequency phase synchronization, illustrated in Figure 2, is of basic interest

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