

Authenticating the subjective: a naturalistic case study of a high-usability electronic health record for virtual reality therapeutics

H J Moller¹, L Saynor²

¹Faculties of Medicine, Knowledge Media Design, Music and Health Research Collaboratory,
University of Toronto, Toronto, CANADA

^{1,2}Digital Futures Initiative, OCAD University
Richmond St, Toronto, CANADA

^{1,2}PRAXIS Holistic Health
Carlaw Ave, Toronto, CANADA

drmoller@praxisholistic.ca, lsaynor@praxisholistic.ca

¹*kmdi.utoronto.ca*, ^{1,2}*www.ocadu.ca*, ^{1,2}*praxisholistic.ca*

ABSTRACT

Using data from our established Technology-Enhanced Multimodal Meditation (TEMM) stress-reduction program employing the electronic health record system Wellpad, we illustrate the value of developing a qualitative data-analysis approach to inform clinical practice in the rapidly emerging field of immersive therapeutics. In examining “rich data” of a naturalistic 50-patient TEMM cohort, indicates that, as with design of VR therapeutics, there is a highly salient role for immersive diagnostics, which ultimately relates to consumer satisfaction, both for patient and health-care practitioner.

1. INTRODUCTION

Following a rocky era over the past quarter century that industry pioneers might refer to as a multi-industry synergistic vision quest, we are now entering a new era of VR’s impact on health and wellness (Durlach & Mavor, 1995). Overlapping with an industrialization of medicine and psychology into models embracing operational protocols, patient management models, and treatment guidelines, a need and opportunity currently exists for setting gold standards to inform clinical practice. In particular for evaluations exploring novel immersive or virtual reality therapy or rehabilitation tools, rather than understanding a patient’s experience in terms of rote rating questionnaires, getting at the ultimate experience meaning of wellness and illness is called for at this juncture to optimize care planning.

Information systems are a key success factor for medical research and healthcare. Currently, most of these systems apply heterogeneous and proprietary data models, which impede data exchange and integrated data analysis for scientific purposes (Dugas et al, 2016). In this sense, we note the general problem for reporting of data related to VR mental health treatment and rehabilitation that a *lingua franca* of clinically relevant self-state descriptions and data-capturing that cuts across the wide variety of conditions and circumstances seen and treated in a psychiatry or psychology setting, whether these be anxiety, mood, trauma or organic brain disorders, including often co-occurring complex medical comorbidities such as disturbances of musculoskeletal or sleep health. As we will discuss, this is of essence in being able to inform naturally occurring clinical realities beyond more artificially controlled academic or pre-clinical research studies.

What seems to be important is to arrive at a consensus regarding what “wellness” or “wellbeing” entail on a symptomatic/experiential level in a manner that cuts across rote DSM psychiatric classification categories. This is necessary due to the inherent heterogeneity of patients seeking wellness care. Additionally, finding mechanisms to creatively incentivize patients to offer up rich authentic data, whether through pre- and intra-session data (psychophysiological, gamified self-report, video capture, etc) makes for a more holistic evaluation potential that should be more fully entertained by clinicians and researchers. There is also the *Zeitgeist* of the “personalized medicine” era to consider. Personalized medicine research implies that on a clinical every individual patient is an individual “experiment”, with unique circumstances and issues, bearing “rich/thick data”, putting the VR industry in pole position to deliver authenticity beyond numbers.

Employing quantitative and qualitative considerations, we now report on our group’s experience with ongoing development of Wellpad, an inclusively designed (Marti, 2012; Nussbaumer, 2001) and gamified (John, 2015) diagnostic electronic health record system intended to optimize the synergistic data flow in a busy operational medical setting.

2. METHODS

Drawing from a clinical database query of over 450 patients, a sample of 50 patients was identified who had completed between 7 and 15 scheduled TEMM sessions at the PRAXIS Holistic Health and Rosedale Wellness Centre relaxation hubs in Toronto, Canada before February 14, 2016. These consenting participants resided within the Greater Toronto Area (GTA), the furthest participant being located an hour away from the health centres.

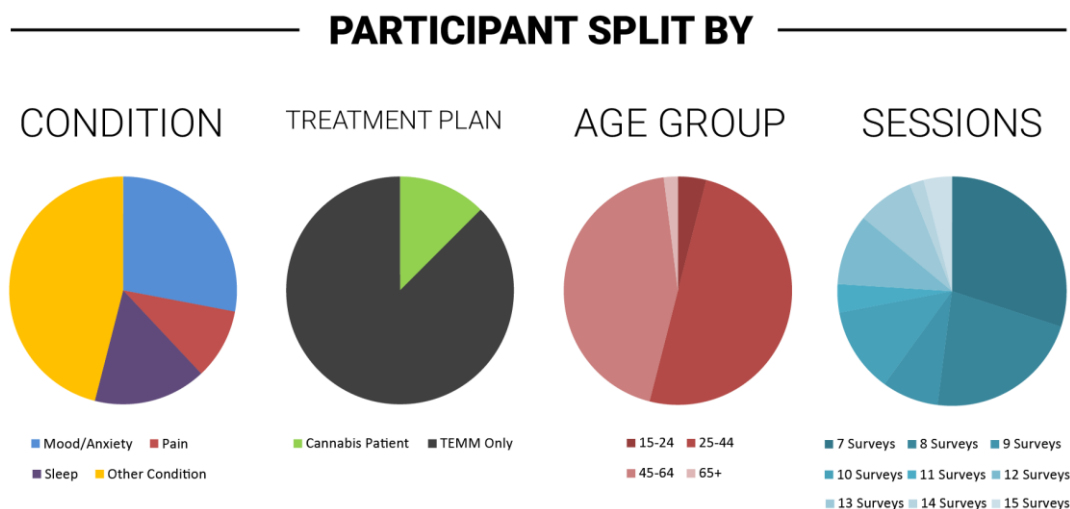


Figure 1. Various proportional classifications of the 50-patient sample.

2.1 Easy Data Collection Protocol

Keeping a simple Electronic Health Record of participants, VR practitioners can create personalized wellbeing experiences responsive to the needs and motivations of the modern leisure-seeking consumer. Knowing the balance of demographics like condition, current treatments, age, and length of treatment among a user sample as in Figure 1 is a key driver for praxis by feeding real world results back into the development of more effective new immersive therapeutic programs.

After participant suitability for TEMM is authenticated and she completes a brief intake survey, baseline 1-5 likert scores for relaxation, pain, sleep quality, and energy in recent times are captured by the inclusively designed iPad-based Wellpad EHR system. Popular medically supervised meditation programs like “Creative Problem Solving” and “Balancing Your Moods” are delivered to the patient via non-invasive synthetically packaged leisure-state meditation experiences with relaxing visual, auditory and haptic channels in chair and bed delivery systems (Moller & Bal, 2013).

2.2 Holistic Diagnostic Progress Tracking

Progress tracking with Wellpad at PRAXIS Holistic Health and Rosedale Wellness Centre currently focuses on a longitudinal visualization of wellbeing captured before each weekly TEMM session. The patient’s 1-5 score for each attribute in recent time and potentially significant patient comment/context are plotted visually as seen in Figure 2 and reviewed with physician during the consultation. The utility of this narrative cue for inclusively exploring the experience user’s health over time has been demonstrated before (Moller & Saynor, 2014; Moller et al, 2015) and will be expanded upon by adding followup surveys directly after the treatment session.

The 5 attribute scores for each survey submission are averaged into a general Wellness Score, which is readily stacked with peers to identify broader trends. For instance, Figure 3 shows a maximalist 50-patient spectrum of self-reported wellbeing over time, which can also be averaged across the group (Figure 4) or split by question average (Figure 5) to check for trends among disparate patients or very specific groups.

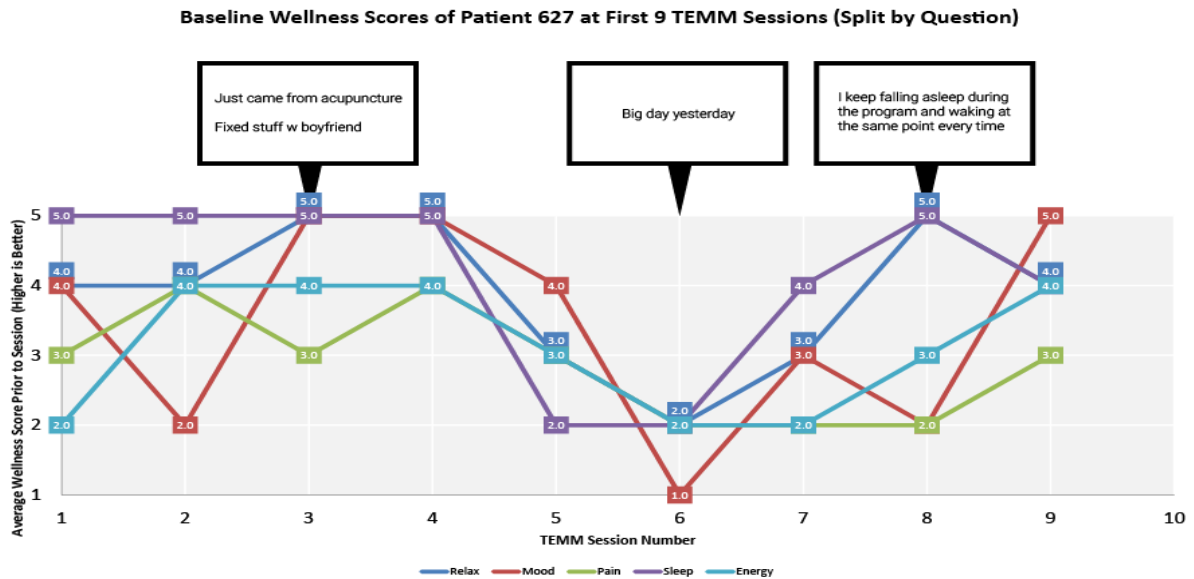


Figure 2. One Stress/Anxiety patient’s wellbeing over time while undergoing TEMM treatment. The plunge before the participant’s 6th session suggests the patient may need extra attention

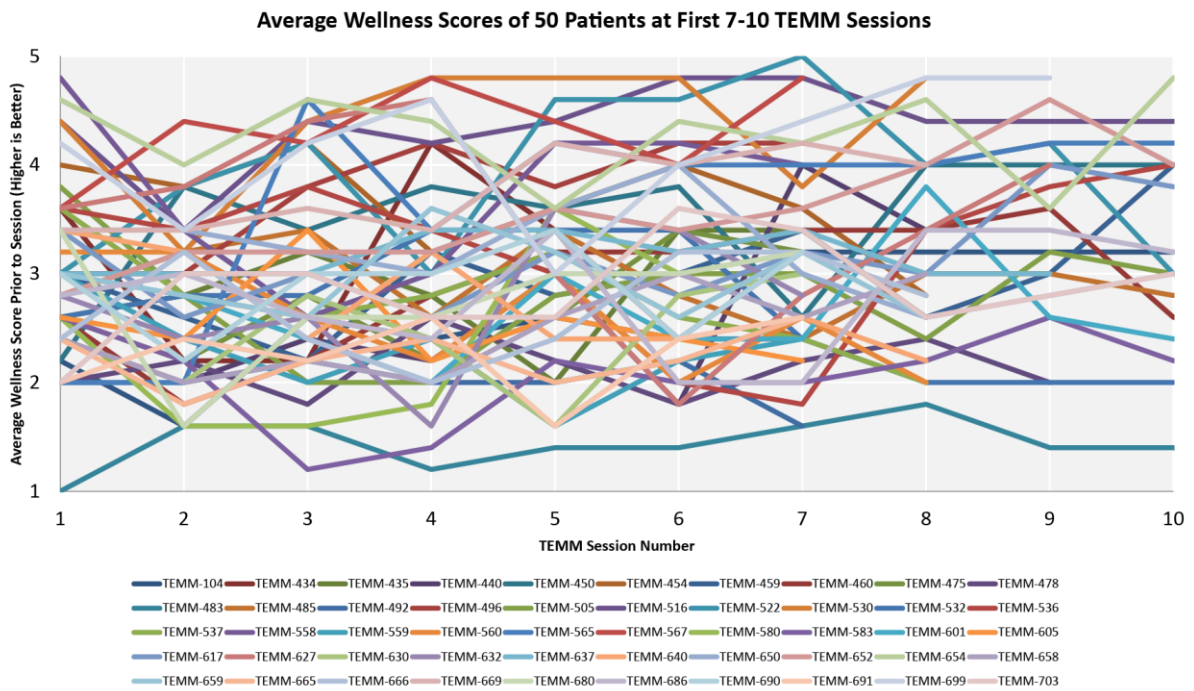


Figure 3. 50-Patient spectrum of average patient wellbeing over time may reveal broader trends.

Section 2.3 Exploring the Future Potential of Rich Data

While we believe in evidence-based approaches, evidence does not necessarily consist of structured data points. In VR research, we believe that the life experiences need to be accounted for to derive optimal knowledge. This is particularly true when studying mental health and the complexity of changes in consciousness common in stress and anxiety patients.

This notion feeds into the multimodal nature of the immersive therapies used at our health centre and others endeavouring immersive/VR therapies; we advocate for a further future promotion of multimodal diagnostic data-gathering, which has already been embraced for some time by VR researchers in the form of psychophysiologic (EEG, galvanic skin conductance, EKG heart rate variability, polysomnography etc.) monitoring, eye-movement or blink tracking, motion capture and psychomotor performance tracking inherent to gamified therapeutics. Now that the mobile technology industry is experiencing a commercial proliferation of

health and wellness devices and aps (e.g. smart watches, fitness- and brainwave-trackers), we are learning about consumer acceptance, tastes and preferences of what aspects of their daily experiences we can authentically capture to better understand patient wellbeing.

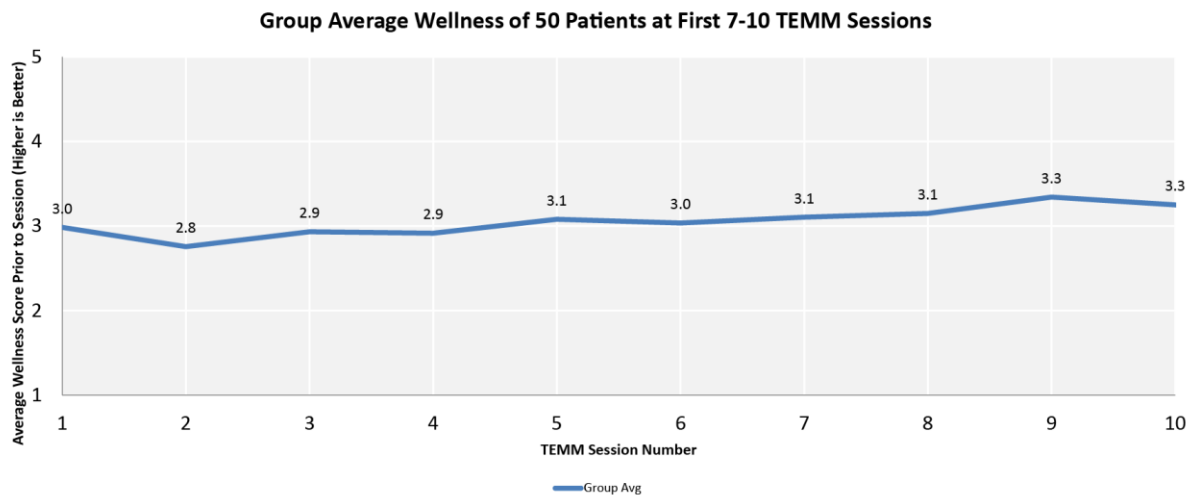


Figure 4. 50-patient trend of average patient wellbeing over time shows a modest net increase.

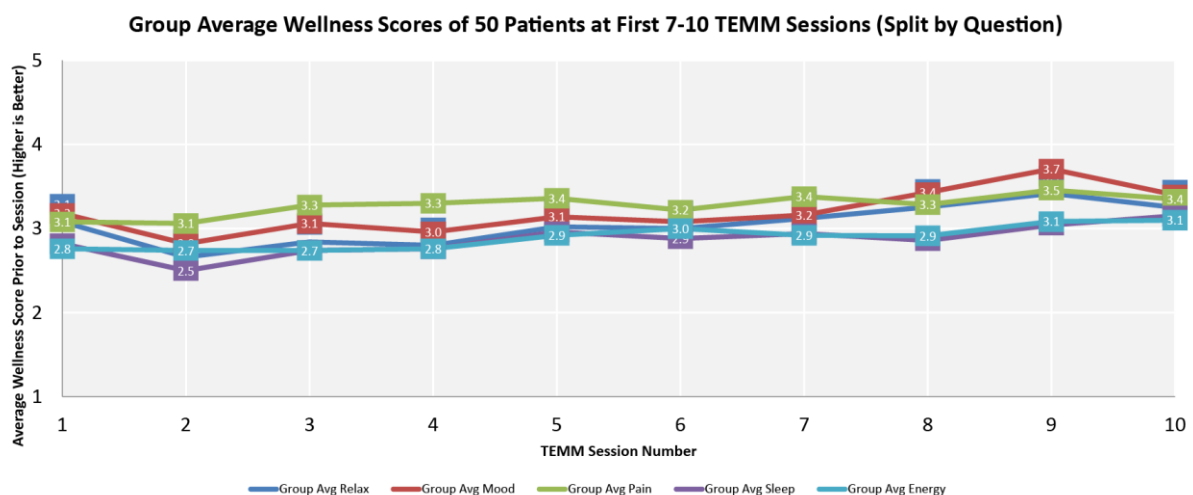


Figure 5. 50-patient wellbeing trend split by question.

To this end, the actual nascent VR health/wellness therapeutics industry is now at a crossroads of ideally informing the technology market of what is useful and helpful for medical or mental health care, as opposed to the tech sector driving the conversation on a top-down level without the expertise or knowledge of what an individual with an illness or disability actually needs to recover or maintain their wellbeing. The often severe challenges that hospitals, clinics, clinicians and patients have encountered with the vast array of existing EMR’s underscores this challenge and opportunity for the VRT community.

How to make an abundance of complex data less overwhelming is a key question in product evaluation for electronic health records. Usability is most certainly one part of the answer, as we have previously argued (Moller and Saynor, 2014, Moller et al 2015), and here it must be explicitly stated that the “user” is the patient and clinician, and not the “man-behind-the-curtain” digital designer. This means that, as with VR therapeutics, no matter how innovative or aesthetically appealing a VR program may be, without ongoing, often laborious iterative upgrades in arriving at a better and better fit between user needs/preferences and the evaluation tool, it quickly is threatened with obsolescence.

In general, our observation is that patients left with an open invitation to offer up qualitative supplementary data (e.g. unique psychosocial life situations that may significantly affect rote symptom report at the time of therapeutic engagement) will not frequently volunteer this unless specifically monitored or prompted, meaning that much more creativity is needed on behalf of design teams to elicit meaningful qualitative data to inform about user experience.

On a neuroeconomics level, the “low-risk” path of least resistance of putting in minimum effort required to obtain “reward” of completing the therapeutic endeavour likely remains the health-care consumer’s most frequent choice on the utility curve (Becker et al, 1964). For this reason we have previously advocated for inclusive design usability approaches in VR therapeutics that, not just because making things easier to understand or enjoyable for a disabled individual is often the morally right thing to do on a public health level, but also because fun, “easy-to-use” and inherently engaging health-care consumer products are also those with the greatest market potential.

Evidently, most battle-weary clinicians in the mental health or physical medicine rehabilitation trenches would rather look at an easy-to-grasp Gestalt that captures the salient features of clinical progress, compared to “business as usual” standards in paper and/or electronic diagnostics. These currently consist of either manually combing through clinical notes or unorganized spreadsheet of data that is not organized into an experience readily digested by the clinician. In fact, it is puzzling that data visualization optimization has not been a focus of intense research and development by electronic health record vendors. (Bach et al, 2015)

3. CONCLUSIONS

In closing, when we introduced the imperative of usability and gold standards in EHR’s related to VR/immersive diagnostics based on a generalized health-care culture of managed structural adjustment of patient experiences, we did not intend to imply that there can be no further room for creativity from designer/implementer or clinician.

On a public health level, once patients are assessed on high volume, rapid-fire level in a clinical setting that is more difficult to control than a research environment, the ability to efficiently track salient patient progress patterns is extremely valuable. Rather than viewing clinicians and researchers embracing VR as participating in an increasingly mechanistic or inhumane paradigm, we demonstrate that with the use of inclusive and iterative design processes the entire care flow from demographic data acquisition to symptom elucidation to momentary and longitudinal self-state reports can be optimized and even *authenticated*. With this last term, we refer to the existential Heideggerian notion of *being-in-the-world authenticity* (Steiner & Reisinger, 2006) that is also of interest in leisure/recreation experience industries like tourism and hospitality. Here, by accommodating to understandings of consumer tastes, preferences as well as ease of understanding and usability, relevant data can be more readily volunteered in a manner that seems less extractive and more akin to a playful flow-state, which we would argue is more akin to our natural state of consciousness.

While we do not necessarily suggest that our conceptual digital model of the busy clinician’s critical opening line of “how are you doing?” is all-encompassing or negates others, we point to its popularity and acceptance rate in our clinic population amongst frequently quite disabled patients, and our experience in employing it clinically on a routine basis over the past year. Wellpad is driven by a pragmatic need to triage patient care plans (e.g. specialist referrals or medication changes based on specific symptom clusters); alongside this, by a desire to transition the “interview” into a humanized discussion to make the patient/consumer feel understood, while making the experience less burdensome and enjoyable for clinicians.

We continue to support and be engaged in system optimization, including incorporation of real-time data flow, whether physiological or camera-captured. Further research more fully exploring the concept of *Global Medical Wellbeing Assessment* is also warranted. As a clinical research and development team accustomed to the need for a fluid exchange between theory and praxis, we finally emphasize the importance of iterative design and continuous quality improvements to closer approximate tool optimization, whether therapeutic or diagnostic.

Acknowledgements: We are grateful to our participants for providing feedback on the Wellpad design and PRAXIS colleagues Kunal Sudan and Robelyn Soriano for collecting data and assisting patient intake.

4. REFERENCES

- Bach, DS, Risko, K, Zaran, F, Farber, M, and Polk, G, (2015), A Pharmacy Blueprint for Electronic Medical Record Implementation Success, *Hosp Pharm*, 2015 Jun;50(6):484-95. doi: 10.1310/hpj5006-484.
- Becker, GM, Degroot, M, and Marschak, J, (1964), Measuring utility by a single-response sequential method, *Systems Research and Behavioural Science*, 2006 Dec;9(3):226-32. doi: 10.1002/bs.3830090304.
- Csikszentmihalyi, M, and Kleiber, DA, (1991), Leisure and self-actualization, In B.L. Driver, P.J. Brown, & G.L. Peterson (Eds.) *Benefits of Leisure* (pp 91-102). State College, PA: Venture Publishing.

- Dugas, M, Neuhaus, P, Meidt, A, Doods, J, Storck, M, Bruland, P, and Varghese, J, (2016) Portal of medical data models: information infrastructure for medical research and healthcare, Database, Oxford, 2016 Feb 11;2016. pii: bav121. doi: 10.1093/database/bav121. Print 2016.
- Durlach, NI, and Mavor, AS, (Eds), (1995), *Virtual REALITY: Scientific and Technological Challenges* National Research Council, NATIONAL ACADEMY PRESS, Washington, D.C.1995
- Gregg, L, and Tarrier, N, (2007), Virtual reality in mental health: a review of the literature, *Social Psychiatry and Psychiatric Epidemiology*, 42(5), 343-54.
- John, J, (2015), Gamification the name of the game, *NZ Business + Management*, Vol. 29 Issue 11, p42-43. 2p.
- Marti, P, (2012), *Enabling through Design: Explorations of Aesthetic Interaction in Therapy and Care*. Technische Universiteit Eindhoven, Eindhoven, Holland.
- Moller, HJ, (2008), From Absence to Presence: Blurred consciousness and sleep states, *PRESENCE 2008, the 11th Annual International Workshop on Presence*, Padova, Italy.
- Moller, HJ, and Saynor, L, (2014), Wellpad: An inclusively designed tablet-based digital medical record with optimized efficiency and usability. *MobileHCI 2014*, Sept 23-26, 2013, Toronto, Canada.
- Moller, HJ, Saynor, L, Sudan, K, and Tabak, D, (2015), Wellpad: A New Standardized Assessment and Data Visualization Tool for Clinicians and Researchers, *Proc. IACM 2015 8th Conference on Cannabinoids in Medicine 17-19 September 2015* in Sestri Levante, Italy
- Moller, HJ, Bal, H, (2013), "Technology-enhanced multimodal meditation: Clinical results from an observational case series", *Proc 10th International Conference on Virtual Rehabilitation*, Philadelphia, PA 26-29 Aug. 2013, pp 1-9.
- Nussbaumer, LL, (2001), *Inclusive Design: A Universal Need*, Fairchild Books, New York, NY
- Pashler, H, and Wagenmakers, EJ, (2012), Editors' Introduction to the Special Section on Replicability in Psychological Science: A Crisis of Confidence? *Perspectives on Psychological Science* 7: 528-530,
- Steiner, CJ, and Reisinger, Y, (2006), Understanding existential authenticity *Annals of Tourism Research* 33(2) 299-318.