Participant Materials – BP#10: AI Technology and Nursing.   (file 1 of 3 related files)

Dr. Lundy Lewis
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[Dr. Lewis will be the **Moderator** for our February 8th BP#10 Bridge Project event.]

Dr.Jodi Forlizzi
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Bio
Jodi Forlizzi is the Herbert A. Simon Professor of Computer Science and Human-Computer Interaction in the School of Computer Science at Carnegie Mellon University. She is also the Associate Dean of Diversity, Equity, and Inclusion in the School of Computer Science. She is responsible for establishing design research as a legitimate form of research in HCI that is different from, but equally as important as, scientific and human science research. Jodi has advocated for design research in all forms, mentoring peers, colleagues, and students in its structure and execution, and today it is an important part of the HCI community. Her current research interests include designing human-robot interaction as a service and human-AI collaboration in the domains of eldercare, accessibility, service work, and overall wellbeing.

[The following describes the introductory presentation which will be given by Dr. Forlizzi at the outset of our February 8th BP#10 event.]

The Role of Interdisciplinary Research in Socially Responsible AI
What we design is changing; therefore, how we design is also changing. In this talk, I will set the context for the role of design in creating purposeful and pragmatic technological systems, both historically and today. I will then highlight some of our interdisciplinary research showing the impact of design in hearing the voices of all stakeholders in creating, developing, and deploying AI and autonomous systems, with the goal of creating better social systems, better economic relations, and a better world in which to live.

Ngan MacDonald
Chief of Data Operations
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Artificial Intelligence at Northwestern University (AI@NU)

[Ms MacDonald has supplied two PDF files (posted separately here on our website), one of which serves the content of her tutorial presentation, and one of which contains the content of handouts which she shall use.]

Landon Horton
doctoral candidate
(Landon's dissertation topic is directly relevant to the goals of BP#10.)
Kramer School of Nursing
Oklahoma City University

[Landon's tutorial, representing the nursing community, will use the following content.]

TUTORIAL concerning ICU NURSES

PREFACE: The purpose of the morning Tutorials in this Bridge Project event is to help prepare its participants, who represent very different professional communities, for conducting effective communication and collaboration during the afternoon discussions. The afternoon session makes use of the morning preparation in open forum collaborative discussions aiming to formulate Grand Challenges that can motivate and help guide future design, development , and deployment of AI tools capable of significantly augmenting the work of nurses.

ICU NURSING is DEEPLY CHALLENGING for AI TECHNOLOGY: Indeed, each of the diverse types of nursing presents its own difficult design, development, and deployment challenges for AI technologists seeking to furnish tools that can augment the effectiveness of nurses serving that particular type of heath care. ICU nursing arguably is especially difficult in this respect. Its complexities can include, for example, the presence of patients with multiple comorbidities.

The distinctive vantage point of ICU nursing nonetheless also calls for preparing its Tutorial in terms of the following practical questions for which answers were requested in the part of this event's Preparation Information document addressing any <u>nursing</u> Tutorials:

(1)

What specific capabilities would new AI tools need to have for augmenting our successful performance of tasks necessary in our particular type of nursing during care of our patients ?, and

 (2)

 What specific target measurements would serve our assessment of the augmentation?

The morning Tutorials in this bridging event are intended to sharpen communication and collaboration capabilities of our participating communities for the work of formulating appropriate

Grand Challenges during the afternoon discussions. Question (1) serves the need to assure that our bridging event respects user-centered design of AI healthcare tools, and question (2) aims to supply measures for determining when Grand Challenges have been met.

Issues of Grand Challenges focused entirely upon features of AI technology often can specify precise measurable goals (e.g., numerical percentages of accuracy) which present various technical challenges for AI research and development. Appropriate Grand Challenges for the *AI Technology and Nursing Bridge Project* need to be somewhat different. In particular, their scope likely still will need to include attention to measurable technical capabilities of prospective new AI tools, but it must also pay attention to the importance of interaction, in each case, between the AI tool and the *human* nurse who is *using* the tool. That importance has been empirically demonstrated by games of "Advanced Chess" in which amateur players who are quite adept in interacting with their 'chess machines' as AI teammates have managed to beat Grandmaster players who happened to be less adept in *interacting* with *their* chess machines. Human interaction of nurses with their patients appears to be even more subtle and complex than chess and is recognized as a strong determinant of the healthcare success of their patients – but if we expect the introduction of AI nursing tools to *augment* that success, we ought not neglect *interaction* of nurses *with* those tools as we *design* them. Following this path certainly involves – *but goes beyond* – considering measurable technical capabilities of the AI tools., such as accuracy of detecting irregularities in heart behavior. For example, we need to remember that different nurses using an AI tool may bring different personal levels and kinds of capabilities to the task.

Indeed, this important matter of human and tool interaction can call for attention to the following kinds of topics and open questions which might also invite some forum discussion within this tutorial.

Topics:	**Illustrative Questions:**
Trust	When and why can (and should) the ICU nurse trust the tool?
……	This very important interaction topic can present significant technical
……	challenges to AI technology such as reproducibility of performance
……	measures when patient population data differ significantly from training data.
Time	What time constraints do the ICU nurse's tasks prescribe tor the tool?
……	In ICU nursing, for example, patient treatment may demand very prompt
……	delivery of information for patient treatment, but it also requires that the tool
……	free the nurse with adequate time for patient care.
Transparency	To what extent can the ICU nurse talk with and reason with the tool?
Bias	When might the tool (or the ICU nurse) display bias harmful to the patient?
Learning	How might learning capabilities of ICU nurse and tool differ?
……	Might we want to consider capabilities of each to "teach" the other?
Ethics	Do ICU nurse and tool respect compatible ethical principles?
Risk	Do ICU nurse and tool recognize shared conceptions of risks?
Precision	Do ICU nurse and tool share compatible levels of precision required?
Decision context	Might the tool be better for initial screening and ICU nurse for later work?

Data vs knowledge Might AI best cope with data, and the ICU nurse with knowledge (such as human understanding of human psychological, social, and/or spiritual factors)?

Moreover, ICU nursing care of patients also can be affected by elements of a scope involving healthcare stakeholders beyond the communities of AI technology and nursing upon which our initial one-day project event is concentrated. For example, nurses may need information from sources with which business or legal constraints forbid sharing. At such points, successful care may depend upon decisions within the stakeholder community of, say, governmental legislation, and we expect that our ongoing Bridge Project progressively will be expanding its scope accordingly. Clearly, though, our afternoon open forum Grand Challenge collaboration will benefit from the morning attention to improving communication between the communities being bridged at this time.

In addition to the foregoing considerations, we might be well advised to consider special conditions in which the ICU nurse also is practicing as a holistic nurse. Under such conditions, the following might suggest further appropriate responses to questions (1) and (2):

Assisting patients with psychological problems: Telehealth again makes an appearance in this case. Cardiologist Eric Topol, in his 2019 *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, devotes a chapter to mental health which includes the following relevant citation:

> As Tom Insel, former head of the National Institute for Mental Health, said, "Could anyone have foreseen the revolution in natural-language processing and artificial intelligence that is allowing voice and speech, collected on a smartphone, to become a possible early warning sign of serious mental illness?" (p. 168)

Topics of tool precision and human trust of the tool seem especially likely to be important for holistic nurses, whose scope of care attention explicitly includes the patient's psychological wellness.

Modeling *interactive multilevel* health problems: Consider, for example, a military veteran patient suffering PTSD who encounters unexpected cancer, producing interactive psychological and physiological factors for which predictive modeling for the interaction could be useful to holistic nurses. Deep learning with appropriate training data probably could yield augmenting tools in such cases. Again, AI models of physical yoga practices interacting even with spiritual levels of human personal experience might be possible, turning carefully selected training data into potentially useful tools for holistic nursing.

Interactive multilevel health problems appear to be a defining signature concern for holistic nurses, and they also might be an interesting field for Grand Challenges to AI technology. Contemporary AI healthcare tools employing deep learning are commonly acknowledged (and critiqued) for being successful with applications *of narrow scope* (Is the skin lesion in this medical image melanoma?). Applications spanning physiology, psychology, and possibly spirituality (classically of special interest to *holistic* nursing) invite issues with training data and the like that could be rich with Grand Challenges for AI technology. However, topics of trust, transparency, and ethics could also invite much controversy.

Saving nurse more time for human interaction with patients: The nature of holistic nursing calls for personal interaction of the human nurse with patients at levels of human life which

include biomedical care of the body but also attend to interrelated psychological, social, and spiritual levels. How well AI technology eventually will share with us these latter levels of our being remains to be seen. It has been argued that the currently prevailing architecture of AI systems remains formally at the level of classical Turing Machine computation and it is not going to share with us these subjective phenomena of human mental experience (if at all) until the architecture adds quantum Turing Machine computation which is interactive with the current classical level. Whatever the case, it appears plausible that even current AI is capable, in principle, of substantially accelerating the human nurse's care that concerns purely biomedical care of the body, potentially giving the nurse more time (if healthcare business administration permits it) to engage patients at the higher subjective levels of actual human life One might add that such profound changes in clinical nursing likely also would demand some changes in nursing education.