COMMENTARY

Radiology's "Smart New Deal"

Dieter R. Enzmann[1]

Inspired by the "Green New Deal," diagnostic radiology (DxR) should design and adopt a "Smart New Deal;" "smart" as in smartphones. DxR would be wise to follow Wayne Gretzky's advice, "… skate to where the puck will be." That puck is the sophisticated mobile, small-screen communication device in the form of smartphones, tablets, iPads, etc. In this article, for brevity, "smartphone" is used as shorthand for those well-honed devices which combine compact, sturdy hardware (H/W) with integrated, intelligent software (S/W). Smartphones are an essential professional accoutrement tucked into purses, sport coats, or jean pockets. Ubiquitous smartphones communicate information, establish relationships, and shape healthcare experiences.

A "Smart New Deal" can serve as a force function for DxR to enter this decade's expanding communication era by revamping the efficiency and effectiveness of DxR's main product—the report. Those reports need to broaden their distribution; more intelligently organize information; and minimize the cognitive distance between understanding its information and making decisions or taking actions [1, 2]. Reports must curate information so it is transformed into knowledge via understanding [3]. Smartphones' wide availability and distribution offer continual access to knowledge at the time, place, and moment it is needed by increasingly mobile and flexibly scheduled physicians, healthcare workers, and patients [4]. Leveraging these features will improve patient satisfaction with DxR and elevate its value [5].

Early use of smartphones in COVID-19 AI research revealed broadening of (rural) sampling representation [6]. Smartphone patient portals can save money [7–10]. Unfortunately, smartphone apps popular with patients are currently less popular with radiologists [11]. Radiology uses smartphones for operational functions such as scheduling or patient exam preparation, but not for its core business, conveying understandable diagnostic information.

It will take some "creative destruction" for radiology to create smartphone-information interfaces designed for physicians and patients. The corporatization and industrialization of radiology will increase investment in these interfaces, possibly by non-traditional disruptive players setting new web-based standards. These interfaces will incorporate explanations of quantitation and annotation of key images, multimedia image presentations, and hyperlinks to other relevant information (clinical, genetic, etc.) or links to pertinent, up-to-date, scientific references. This trend will follow internet information giants setting of standards (Microsoft acquired Nuance) in interoperability of interactive webpage use and of "cloud" technologies for processing and storage. A "Smart New Deal" can unshackle radiology from the stagnant 8.5″ × 11″ paper report format. Smartphone reporting will accelerate redesign and stimulate reassessment of DxR reporting philosophy.

That philosophy should contemplate the concept of time becoming individually scarce when information becomes abundant, which it has. A largesse of information actually creates a scarcity of time, a non-renewable resource [12, 13]. Continuously available smartphone reports address this scarcity by letting users filter and choose the time and place of viewing the report [14].

The smartphone force function underlines information theorist Herbert Simon's quote, "What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" [15].

Radiologic information on the smartphone must capture and hold user attention, but because attention consumes time, the report must convey high information content in a minimum amount of time, i.e., a high information to low user time ratio (ITR). This is a prerequisite for report redesign and favors a focused radiology reporting app rather than a "buried" EHR subpage. Total user time, therefore,

✉ Dieter R. Enzmann
denzmann@mednet.ucla.edu

1   Department of Radiological Sciences, David Geffen
     School of Medicine, University of California Los Angeles,
     Los Angeles, CA, USA

encompasses getting attention, viewing, and understanding report information. This should be measured in absolute time, probably minutes because DxR has stiff competition from many information sources for attention and user time [12, 13].

In the competition for user time, DxR needs to differentiate its information, its presentation, and its communication medium. DxR must carve out smartphone real-estate to efficiently transmit and display essential information capable of guiding medical decisions and actions, possibly tailoring the report to user specialty and user location information.

Minimizing ITR requires detailed user knowledge. It should not require malpractice data to learn user behavior [16]. While maintaining trust, DxR needs to leverage smartphone capabilities a la Apple or even Google to learn about how, when, where, and who uses report information [17]. It must learn what information is really understood, what is actually used for decisions and actions, and, in particular, what information is not used [18, 19]. Unused information has negative value as it unnecessarily wastes time. Radiology's smartphone interfaces need to establish a positive, trusting relationship to ensure that DxR's information is read, understood, and effectively used. The smartphone interface should be able to assess who viewed the report (at least by specialty); what was viewed; how often and for how long it was viewed; and when and where it was viewed. Such data should populate a database capable of guiding smartphone report and radiologic service ongoing redesign [20]. If subspecialization is important for maintaining DxR's professional identity, then superior subspecialty information must facilitate sophisticated decision-making when and where it is needed [21, 22].

Cognitive Distance Gap

The raison d'être of radiology is to provide accurate, actionable information for medical decisions. The concept of cognitive distance or load refers to the mental effort needed to bridge the gap between how information is presented, received, and then used in decision-making or physical action [1, 3, 23]. What matters most to users is the amount of energy they have to expend to bridge this gap; obviously, the less the better [14]. The "Smart New Deal" challenges DxR to minimize this cognitive gap in communicating abundant information in the setting of scarcity of time and attention. Google does this by highly organizing information; Apple by ease of information use; while DxR unfortunately does not do either very well. Multimedia, quantitative, integrated image, and information display using user specialty and patient context plus information like location can reduce this cognitive gap while concurrently increasing ITR.

Google and Apple know how their information attracts attention and how much time it takes to absorb and use it. DxR has had limited, sporadic data on how to maintain high ITR. Minimizing time consumed by the report becomes a "Smart New Deal" imperative measured as the total time it takes a user to access and use the report. This measure should appear on operational dashboards [1].

Another way to improve ITR is to increase the value of information content by revisiting the somewhat overstated maxim by Marshall McLuhan, "the medium is the message" [24]. The "Smart New Deal" recognizes that the smartphone medium (H/W and S/W) is integral to converting information into usable knowledge [3]. The smartphone is already a highly polished, ubiquitous medium which can decrease the cognitive distance/load, a major determinant of DxR's value. This value ultimately resides in the eyes of the recipient. DxR can learn from Google and Apple how to look into the "eyes of the recipient" but using more trustworthy, possibly "opt-out" means [17, 25–27]. DxR needs to collect user data to determine what of its report does and does not gain attention and views, and what is or is not understood in facilitating decisions and actions.

Beyond the ITR, the smartphone can decrease a more encompassing time component, the combined absolute time of accessing and viewing the report. This forms a vital part of the DxR experience. Hip pocket access works well. Highly mobile, smartphones dramatically improve this component of the DxR's information business by broadening the how, when, where, and how often of its users. Smartphones will have a central role in improving radiologic experiences which will tap into what is termed "omnichannel" communication: a mix of online and offline information delivery, offline encompassing the important consultation service [28, 29].

Emulating Google and Apple's feedback loops on how to improve information display and user interaction on this new "smart puck" becomes essential. Ever-present access clearly improves and helps create an Apple-like "cool" information experience which can mature into a real relationship with DxR. It can do so by giving the user, whether physician or patient, a sense of control in managing their health in limited time. Movement to healthcare consumerism is well underway and DxR needs to participate through easily accessible smartphone interfaces which, if well designed to be relevant, interactive, and understandable, can build strong physician and patient relationships. This is where the "puck" is heading and there is considerable competition to get there [30].

Apple also offers lessons in building an ecosystem capable of delivering the "best experience" or "cool services" in health with its CEO stating, "healthcare is a major strategic thrust and Apple's greatest impact will ultimately be in health" [31–35]. That impact is the "best" experience in managing health information, in making decisions, and in

affording patients interactive control [36]. DxR will have competitive and complementary interactions with Apple and Google in its information business, even if it is only "Google inside" [37].

As Charles Handy, a management philosopher, stated, "The world keeps changing. It is one of the paradoxes of success that what got you where you are, won't keep you where you are" [38]. DxR has been highly successful in its high-volume, transactional report business, even without in-depth knowledge of its customer's use of its report. It is time for a "Smart New Deal" in which DxR uses the smartphone to revamp its report for new information and time demands, and for DxR to create experiences that evolve into loyal customer relationships. These become even more important in defining perceived value of our field and of specific practices as radiologist's physical presence recedes with expansion of teleradiology business models.

Author Contribution I am the sole author of this manuscript.

Declarations

Conflict of Interest The author declares no competing interests.

References

1. Porter ME, Heppelmann JE: Why every organization needs an augmented reality strategy. Harvard Business Review. November-December 2017:45–57.
2. Puri P, Jha S: Artificial intelligence, automation, and medical education: lessons from economic history. J Am Coll Radiol 18:1345-1347, 2021. https://doi.org/10.1016/j.jacr.2021.05.002
3. Wartman SA: The empirical challenge of 21st century medical education. Acad Med 94:1412-1415, 2019. https://doi.org/10.1097/acm.0000000000002866
4. Escape from the city. The Economist. May 6, 2021:72.
5. Brady AP: The vanishing radiologist – an unseen danger, and a danger of being unseen. Eur Radiol 31:5998-6000, 2021. https://doi.org/10.1007/s00330-021-07723-1
6. Rangarajan AK, Ramachandran HK: A preliminary analysis of AI based smartphone application for diagnosis of COVID-19 using chest X-ray images. Expert Syst Appl 183:115401, 2021. https://doi.org/10.1016/j.eswa.2021.115401
7. O'Connor M: Access to imaging exams via online portals saves money for patients, hospitals. Health Imaging. June 11, 2020. Available at https://www.healthimaging.com/topics/imaging-informatics/imaging-exams-online-portals-saves-money-patients-hospitals. Accessed 18 October 2021.
8. Stempniak M: Radiology providers struggling to share images in a timely fashion, steer patients to portals. Radiology Business. January 7, 2021. Available at: https://www.radiologybusiness.com/topics/imaging-informatics/radiology-struggling-share-images-timely-fashion. Accessed 18 October 2021.
9. Cristofaro M, Piselli P, Pianura E, Petrone A, Cimaglia C, Di Stefano F, Albarello F, Schininà V: Patient access to an online portal for outpatient radiological images and reports: two years'
10. experience. J Digit Imaging 33:1479-1486, 2020. https://doi.org/10.1007/s10278-020-00359-5
10. Holder J, Tocino I, Facchini D, Nardecchia N, Staib L, Crawley D, Pahade JK: Current state of radiology report release in electronic patient portals. Clin Imag 74:22-26, 2021. https://doi.org/10.1016/j.clinimag.2020.12.020
11. Bassett M: Mobile app popular with patients, not physicians. Official Newspaper of the RSNA Annual Meeting. December 3, 2019:13A.
12. Gilder G: Life After Google: The Fall of Big Data and the Rise of the Blockchain Economy. Washington, DC: Regnery Gateway, 2018:22.
13. Gilder G: Life After Google: The Fall of Big Data and the Rise of the Blockchain Economy. Washington, DC: Regnery Gateway, 2018:183.
14. Siggelkow N, Terwiesch C: The age of continuous connection. Harvard Business Review. May-June 2019:64–73.
15. Simon HA: Designing organizations for an information-rich world. In: Computers, Communication, and the Public Interest. Martin Greenberger, Ed. Baltimore: Johns Hopkins Press, 1971:40-41.
16. Rosenkrantz AB, Siegal D, Skillings JA, Muellner A, Nass SJ, Hricak H: Oncologic errors in diagnostic radiology: a 10-year analysis based on medical malpractice claims. J Am Coll Radiol 18:1310-1316, 2021. https://doi.org/10.1016/j.jacr.2021.05.001
17. Mickle T, Schechner S, Haggin P: Google to curb app-data tracking. Wall Street Journal. February 17, 2022:A1+A4.
18. Farmer C, O'Connor DA, Lee H, McCaffery K, Maher C, Newell D, Cashin A, Byfield D, Jarvik J, Buchbinder R: Consumer understanding of terms used in imaging reports requested for low back pain: a cross-sectional survey. BMJ Open 11:e049938, 2021. https://doi.org/10.1136/bmjopen-2021-049938
19. Nakamura Y, Hanaoka S, Nomura Y, Nakao T, Miki S, Watadani T, Yoshikawa T, Hayashi N, Abe O: Automatic detection of actionable radiology reports using bidirectional encoder representations from transformers. BMC Med Inform Decis Mak 21:262, 2021. https://doi.org/10.1186/s12911-021-01623-6
20. Dargan R: New informatics tools are helping patients understand radiology reports. Official Newspaper of the RSNA Annual Meeting. December 2, 2019:13A.
21. Neri E, Gabelloni M, Bäuerle T, Beets-Tan R, Caruso D, D'Anastasi M, Dinkel J, Fournier LS, Gourtsoyianni S, Hoffmann R-T, Mayerhöfer ME, Regge D, Schlemmer HP, Laghi A: Involvement of radiologists in oncologic multidisciplinary team meetings: an international survey by the European Society of Oncologic Imaging. Eur Radiol 31:983-991, 2021. https://doi.org/10.1007/s00330-020-07178-w
22. European Society of Radiology (ESR): The identity and role of the radiologist in 2020: a survey among ESR full radiologist members. Insights Imaging 11:130, 2020. https://doi.org/10.1186/s13244-020-00945-9
23. Enzmann DR, Arnold CW, Zaragoza E, Siegel E, Pfeffer MA: Radiology's information architecture could migrate to one emulating that of smartphones. J Am Coll Radiol 17:1299-1306, 2020. https://doi.org/10.1016/j.jacr.2020.03.032
24. McLuhan M: Understanding Media: The Extensions of Man. London: Routledge & Kegan Paul, 1960.
25. Stern S, Nguyen N: Apple privacy feature gives users the reins. Wall Street Journal. April 8, 2021:B1+B4.
26. Higgins T: Apple, Facebook tangle on privacy. Wall Street Journal. January 29, 2021:A1+A4.
27. Winkler R: Apple to expand health portfolio. Wall Street Journal. September 22, 2021:B4.
28. One-to-one commerce: The Economist. March 13, 2021:3–4.
29. Land left to conquer: The Economist. March 13, 2021:12.

30. Kalia V: Radiology reports must adapt as patient needs evolve and access improves. Acad Radiol 27:440-441, 2020. https://doi.org/10.1016/j.acra.2020.01.001
31. Morgan Stanley Research Report: Don't underestimate Apple's move into healthcare. April 2019:16.
32. CB Insights: Apple is going after the healthcare industry, starting with personal health data. January 8, 2019. Available at https://www.cbinsights.com/research/apple-healthcare-strategy-apps/. Accessed 18 October 2021.
33. CB Insights Research Brief: Apple in healthcare. Available at https://www.cbinsights.com/reports/CB-Insights_Apple-In-Healthcare-Briefing.pdf. Accessed 18 October 2021.
34. McGee P: Apple prepares for era of devices beyond iPhone. Financial Times. September 9, 2019:8.
35. Morgan Stanley Research Report: Don't underestimate Apple's move into healthcare. April 2019:1.
36. Surgical intervention: The Economist. February 3, 2018:53–55.
37. Anastasijevic D: Mayo Clinic, Google launch AI initiative for radiation therapy. Mayo Clinic News Network. October 28, 2020. Available at https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-google-launch-ai-initiative-for-radiation-therapy/. Accessed 18 October 2021.
38. Handy C: The Age of Paradox. Boston: Harvard Business School Press, 1994:60.