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## From Legibility to Disambiguation: Typographic Design Strategies to Prevent Misreading

The problem of error in medicine prescription and application is a widely recognized threat to patient safety, and it is also recognized that a relatively common source of problems is in the communication and interpretation of written or printed medicine names and dosages [Dean et al, 2002]. Confusion of names, confirmation bias, and dosage errors are some of the causes of medical error that are the result of visual representation of words and figures, [Lizby 2005] and thus that may be addressed through improved approaches to typographical communication. Although misinterpreted handwriting is often the cause of medical error in the administration of medicine [Sellen, Senders forthcoming], increasingly, the ordering, prescription, and administration of medicine is performed on various devices, most notably as part of Computerized Provider Order Entry systems (CPOE), [Niazkhani, 2009] It is becoming more common practice for medicine names to be entered by keyboard and displayed and communicated in a typeface resident on the printing or electronic screen device. This suggests that investigation of the problems and possibilities of the typographic dimensions of these media is appropriate, and further, that the affordances of these media should be considered in devising typographic strategies to promote disambiguation. There have been many studies on the principles of legibility over the last hundred years [Lupton 2003], but contextualized research is rare. In terms of general legibility studies, the research has been framed in terms of print legibility, and on screen (typically, desktop computer monitors), the comparative legibility of faces or characters within a typeface, [Hersh et al 1979, Beier 2012] all with the intention of establishing or refining general typographical principles. Relatively little work focused on typographical communication has been done from a broader human factors point of view. Furthermore, legibility studies in the past have tended to take a very positivist and tightly-framed approach to legibility, and not recognizing the complexity and variation of different contexts of use. Legibility tests are often evaluated on the basis of speed and ease of reading. However, the danger of presumptive errors can be the result of favorising these aspects. In medical situations it is reasonable to presume that most names are read easily, quickly, and correctly. (After all, even though medical errors are not uncommon, correct administration of medication is unquestionably the normal case.) [Wilkins 2008] However, it is also important to recognize that in clinical practice, errors related to typography are likely to lead to adverse, even fatal, consequences. Therefore, simply accepting studies of general legibility is inadvisable for use in a clinical environment. The medical environment is complex, and the stakes are different than they are in most legibility studies, where the aim is a statistically high level of comprehension over an optimal amount of time. Materials relating to the clinical environment are often restatements of widely accepted but largely untested typographical principles, or investigations of the application and treatment of typefaces, but with no attention to the development of typefaces themselves [Gabriele 2006, NPSA 2007]. The medical environment is complex, and the stakes are different than they are in most legibility studies, where the aim is a statistically high level of comprehension over an optimal amount of time. The increasing resolution and application of electronic display screens and the increasing abilities of software to adapt to user needs, and the availability of font editing software provide the opportunity to design a typographical system that allows users to decide on and control what typographical characteristics best suit their purposes in different contexts, such as dynamically disambiguating one medication name from another, or one dosage form from another.

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