

**Human-centered incubator
Beyond a design concept**

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LETTERS TO THE EDITOR

Human-centered incubator: beyond a design concept

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We read with interest the paper by Ferris and Shepley¹ on a human-centered design project with university students on neonatal incubators. It is interesting to see that in the design solutions and concepts as presented by Ferris and Shepley,¹ human-centered design played an important role.

In 2005, a master thesis project was carried out in the Delft University of Technology, following a similar human-centered design approach.^{2,3} In that design project we also addressed the noise level inside the incubator, as several studies^{4,5} have found that incubators' climate systems itself cause sound levels inside the incubator far above 45 dBA, as recommended by the American Academy of Pediatrics.⁶

The resulting incubator concept, called the BabyBloom Incubator, incorporates many of the features that were presented in the concepts of the mentioned article (for example, sound monitoring and camera feed), although in the field of ergonomics more radical design decisions were made (for example, possibility for full placement over mother's bed).

Recently, the final design received CE certification, and since that point on it is available on the European market. Therefore, we think that the statement that 'the fundamental design of the incubator has remained largely unchanged for at least 30 years' is obsolete.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Encouraging developments in incubator design

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We would like to acknowledge and applaud the efforts of Goossens and Willemsen¹ as well as BabyBloom Healthcare for the design and development of their neonatal incubator, which has recently become available on the European market. Similar to our recent incubation system research and design project,² BabyBloom's incubator was designed using a 'human-centered' approach, as detailed in Willemsen's master thesis.³ While the data collection and analysis methods differed somewhat between our independent efforts, both efforts followed a design philosophy that focused on supporting the needs of select user groups, as opposed to the more traditional design approaches that tend to be driven by the technical capabilities of existing technologies (i.e., a 'technology-centered' approach). Both efforts also emphasized that the needs of not only the neonatal patient but also of family members and medical personnel should be considered in the design process in order to support a well-functioning 'incubation system'.²

It is encouraging but not wholly surprising to see that some of the concluding design recommendations we offer in Ferris and Shepley² are similar to those implemented in the BabyBloom design, such as including sound monitoring capabilities and video

feeds to support nonintrusive viewing of the infants, as well as taking efforts to make the incubator exterior more aesthetically pleasing and comforting for both patients and families. Our parallel human-centered analyses also identified many of the same important design problems (such as inadequate protection from lighting and sound levels that are above recommended limits), even if there were broad differences in the way the problems were addressed. One factor that likely affected the breadth of design solutions is that the students conducting the design project in Ferris and Shepley² were not required to directly consider the component or manufacturing costs for their designs and in fact were encouraged for some project phases to provide 'sky is the limit' solutions that were unconstrained by costs. Obviously, BabyBloom needed to consider component and manufacturing costs in the process of bringing their design to market, which undoubtedly made the design problem more challenging. The fact that they have successfully met their design goals while remaining economically viable can serve to validate and reinforce the value of the human-centered design approach. Indeed, as Goossens and Willemsen suggest,¹ with the growing commercial availability of the BabyBloom and other next-generation incubators we may now be starting to realize much-needed and overdue changes in the fundamental design of incubator technologies by following a more human-centered design approach.