Optimizing the coffee distribution in a brew chamber

Julia Bogers, Industrial Design, University of Twente, The Netherlands

In the thesis written by Julia Bogers, the development of a distribution system for a vertical brew chamber in a fully automatic espresso machine is described. This was done by *designing and delivering a Proof of Principle of a distribution system that can be integrated in a vertical brew chamber which can distribute a variable amount of coffee*. The assignment was commissioned by People Creating Value. PCV Group is an engineering consultancy company that specializes in dispensing and dosing solutions. A lot of their knowledge is within the coffee industry. To keep improving their technological insights and knowledge about coffee, a modular demonstrator was built (PCV Group, 2018). The focus in this thesis is on one of the components in this demonstrator: the brew chamber.

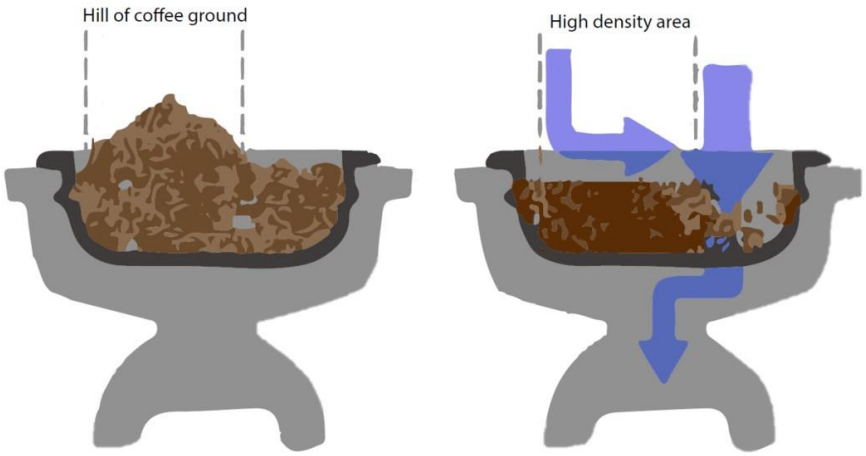

Figure 1: An uneven density causes over- and underextraction.

To improve the quality and consistency of espressos, a Proof of Principle of a distribution system was made that can be integrated in a vertical brew chamber. The distribution of a coffee bed has a direct influence on the taste of the espresso. Because water always seeks the path of least resistance, over- and underextraction occurs. See Figure 1. This strongly deteriorates the taste (Viani, 1995). To design a system to optimize the distribution, firstly extensive research was carried out. Interviews were held, patent research was done and a competitor analysis was performed. As a result the problem was confirmed and the goal of the assignment was determined. A clear demarcation of the assignment was made. Information from the research was used for brainstorms that were held to gain ideas. The brainstorms were held with experts at PCV Group. During the first brainstorm a lot of ideas were formed. The second brainstorm resulted in more concretized and promising ideas. After making a selection out of these ideas, six ideas were chosen. For these six ideas a first simple prototype was made. Tests were executed with these prototypes and the results were analyzed. Three ideas were then let go because the tests showed they would not work well enough to actually be used. The three ideas that were left were taken to the next phase.

In prototyping phase 2 two set-ups were developed. One of the set-ups would enable the distribution of coffee. Two of the concepts could be tested using this set-up. The second prototype would be used to compress the coffee, the third concept could be tested using this set-up. The prototypes can be seen in Figure 2 and 3.

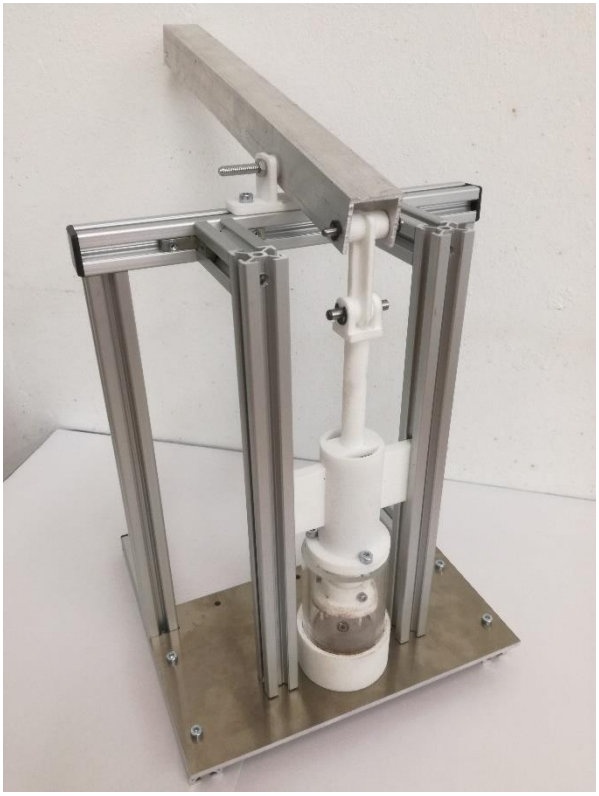

Figure 2: The distribution set-up.

Figure 3: The compression set-up.

From tests with these three concepts, two turned out to be the most promising. With these last concepts, elaborate tests were done. The height difference in the coffee bed, when using or not using these concepts, was measured. To make a considered decision, other factors like integratability were also taken into account. Eventually a final concept was chosen, a conclusion was written and recommendations were made. The developed system reaches all the ground in the coffee bed and creates an even surface. The coffee can be distributed using this system, and after compression a perfect coffee puck can be created. The system creates better tasting and consistent espressos. To integrate the concept in a vertical brew chamber, more research and tests should be done. The emphasis should be on the stiffness and cleaning of the concept. Eventually the concept can be placed in the demonstrator and the newly gained knowledge can be shown to customers.

References

Viani, A. I. (1995). *Espresso Coffee, The Science of Quality.* Oxford: Elsevier Academic Press.

PCV Group. (2018, Mei 17). *PCV Group*. Retrieved from pcvgroup.com: https://www.pcvgroup.com/