Competing with a (virtual) peer

Empirical research stresses that the mere presence of a peer (co-worker) has an effect on the performance of people in work situations. Scholars have studied situations in which people work on individual tasks and are able to observe each other; see Herbst and Mas (2015) for an excellent overview. These co-working situations are usually embedded in some incentive context.

In our recent paper, Graff, Grund, and Harbring (2021), we focus on a competitive incentive environment where employees compete with each other, for instance to obtain a promotion or an exclusive bonus. Such incentives can be analyzed using tournament theory (Lazear & Rosen, 1981), which predicts that people have the highest motivation in "symmetric" tournaments where contestants are equally able. The intuition behind this finding is the so-called "discouragement effect" (Dechenaux et al., 2015): In asymmetric tournaments, the weaker contestant realizes that the likelihood of winning is low and reduces their effort accordingly, while the stronger contestant anticipates this and withholds effort as well. Hence, if we want to provide a productive working environment with effective incentives, we have to be aware of both competition effects and contestant quality.

Moreover, new technologies such as augmented reality (AR) and virtual reality (VR) are emerging at the workplace and may affect employee interactions. Some social or occupational activities might soon be completely shifted to virtual environments – for example, conferences may convene around a virtual conference table, with the participants represented by avatars. Fully-immersive and semi-immersive VR and AR systems are likely to become common in the future, and so will the interaction of real human beings with virtual ones. Thus, a study of the interaction between real and virtual humans is warranted.

Figure 1: A subject, in the foreground, working on the conveyer belt task in the aixCAVE of RWTH Aachen University in the presence of a virtual co-worker. The virtual counters on the wall display running tallies of the avatar's and the test subject's accumulated performance points. In this picture, projected objects appear double and overlaying because of the stereoscopic projection. For the participant in the foreground, who is wearing 3D glasses, the projection is distinct, and the cube in front of her appears to be at the level of her waist.

Our contribution is to study competitive behavior in a specific production environment involving VR technology, which enables us to systematically manipulate incentives and the quality of a virtual

competitor (avatar). In a virtual production hall, subjects work on a simple motoric task, sorting out the defective virtual cubes from the flawless ones on a virtual conveyor belt (see Figure 1). The perfect cubes are blue, whereas those with a defect have an orange side. Depending on the treatment, subjects are alone in the virtual hall or are able to observe an avatar conducting the same task right in front of them.

We conduct the experiment in two phases. In the first phase, we obtain a measure of the subject's ability by observing productivity in this task for ten minutes and paying workers a piece rate of 4 euro cents per performance point – one point per correctly sorted defective cube, minus one penalty point per incorrectly sorted perfect cube. No avatar is present.

In the second phase, the pay scheme varies by treatment and is as follows: In two piece-rate treatments, subjects are paid a piece rate of 4 euro cents per performance point, as in phase one. In one of the piece-rate treatments, an avatar of the same ability is also working on the task, enabling us to compare the behavior of the subjects in this treatment to that of subjects who work alone and receive a piece-rate pay in phase two.

In three subsequent tournament treatments, the participant receives a payment of 8 euro if she achieves a higher performance score than the avatar and 2 euro if she does not. The virtual setup allows us to manipulate the avatar's performance level. In one treatment, we implement an avatar who is less able than the human participant; i.e., an avatar whose performance level is ten percentage points lower than the participant's performance as measured in the first phase. In another treatment, the avatar's performance is equal to the measured performance of the subject, reflecting a symmetric tournament. In the last treatment, the avatar's performance is ten percentage points higher than the subject's first-phase performance, resulting in a tournament against a more able avatar. This setup enables us to disentangle peer effects (the influence of the virtual coworker) from the incentive effect induced by piece rates or competitive tournaments.

The results reveal that both peer effects and the type of competition are relevant for subjects' performance. Under piece rate conditions without the presence of an avatar, subjects made 14 errors on average during a 10-minute test (see Figure 2). That is, they either discarded non-defect cubes or failed to identify defect cubes 14 times. This number was halved when subjects could observe an avatar of similar quality to themselves. Furthermore, the performance in the competitive setup depended on the relative quality of the peer. The error rate was lowest (5.4) when the peer was of equal quality. It was higher (9.0) when the peer was of higher quality and substantially higher (11.5) when the peer was of worse quality.

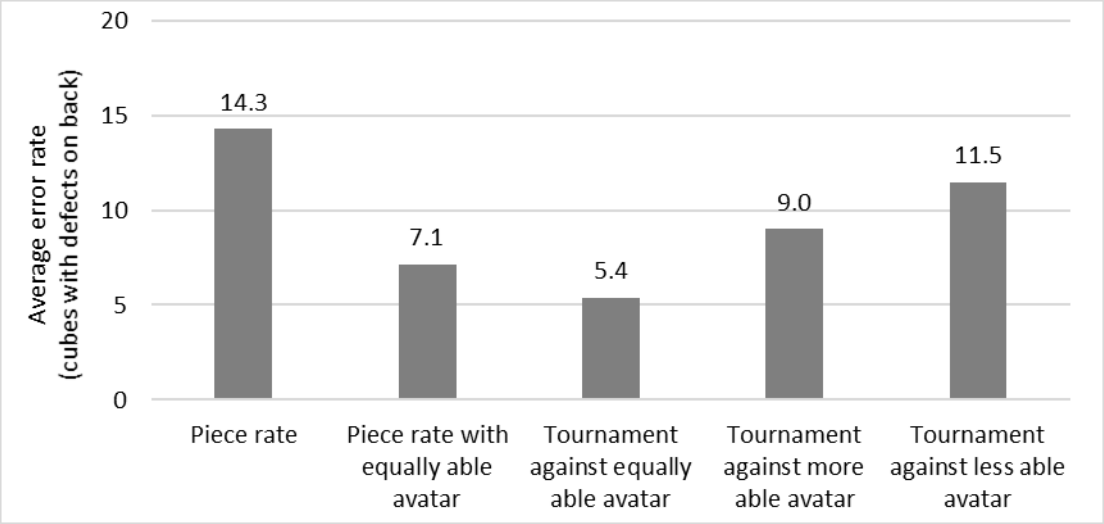

Figure 2: Errors made by human participants

Our results have important implications: Practitioners should be careful when implementing incentives at the workplace and in particular when introducing competition. If tournament settings are introduced, co-workers become competitors and differences in worker ability become increasingly important for performance. Given a situation where only the human worker can adjust her effort, the best results are obtained when matching a subject to a similarly performing or better performing peer, whereas matching with a slower peer reduces performance. Furthermore, our study seems to show that – independent of the monetary incentive scheme – simply observing an equally able co-worker drives up performance. Thus, peers are important, and if used appropriately, they have the potential to improve both performance and the bottom line.

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About the Brief

This CCP research brief is written by Frederik Graff, Christian Grund and Christine Harbring (RWTH Aachen University). It is based on a presentation at the CCP autumn meeting 2020 by Christian Grund as well as the publication: "Competing on the Holodeck: The Effect of Virtual Peers and Heterogeneity in Dynamic Tournaments" in the *Journal of Experimental and Behavioral Economics* (https://doi.org/10.1016/j.socec.2020.101596). For further information, please do not hesitate to contact the authors on frederik.graff@org.rwth-aachen.de, christian.grund@hrm.rwth-aachen.de or christine.harbring@org.rwth-aachen.de.

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