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Hawthorne Effect: An Explanation Based on Decision Theory

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Abstract It is known that people feel better (and even work better) if someone pays attention to them; this is known as the *Hawthorne effect*. At first glance, it sounds counter-intuitive: this attention does not bring you any material benefits, so why would you feel better? If you are sick and someone gives you medicine, this will make you feel better, but if someone just pays attention, why does that make you feel better? In this paper, we use the general ideas of decision theory to explain this seemingly counterintuitive phenomenon.

1 Formulation of the Problem

What is Hawthorne effect. If someone helps a person, this usually makes this person happier. Interestingly, if this someone does not actually help, but simply expresses some interest in this person's problem, this also makes the person happier. For example, when a research team comes to study not-very-comfortable working conditions, this very attention already makes the workers happier – and even boosts their productivity, although the working conditions have not improved and there is no specific plan to improve them. Similarly, the very attention to a sick person makes this person feel better, even though this attention does not lead to any improvement of the health situation. This phenomenon was first documented in a factory called Hawthorne Works. Because of this fact, this effect is known as the *Hawthorne effect*; see, e.g., [1] and references therein.

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It should be mentioned that the feeling-better phenomenon only occurs when the people paying attention have a positive attitude toward the folks they pay attention to. Definitely, if a team would come to analyze the workers for the potential purpose of making them work harder for the same pay, this attention would not make the workers feel better or be more productive.

Why Hawthorne effect? At first glance, this phenomenon sounds counter-intuitive: why would workers feel better if some strangers whom they see for the first time and probably not see again simply study their working conditions? Ok, people crave for attention, but the increase in happiness and productivity is disproportionate: it is comparable to a similar increase caused by the actual improvement in the working conditions.

How can we explain this seemingly counter-intuitive phenomenon? In this paper, we analyze this situation from the viewpoint of decision theory and show that, within this theory, the Hawthorne effect can indeed be naturally explained.

2 Our Explanation

Decision theory: a brief reminder. To come up with the desired explanation, let us recall the main ideas behind decision theory; see, e.g., [2, 3, 4, 5, 8, 9, 10]. Decision theory studies decisions made by rational people, i.e., people whose preferences are consistent: e.g., if a person prefers an alternative A to alternative B and prefers alternative B to some other alternative C, then, when presented with a choice between A and C, this person should select A.

It turns out that under such consistency conditions, decisions of such a rational person can be described by a number-valued function $u(A)$ called *utility* so that out of several alternatives $A_1, \ldots, A_n$, the person always select an alternative with the largest possible value of utility.

A person's utility may depend not only on the objective circumstances of this person, but also on the utilities of others. This dependence is usually described by a linear formula:

$$u_i = u_i^{(0)} + \sum_j \alpha_{ij} \cdot u_j,$$

where $u_i^{(0)}$ is the utility corresponding to the person i's objective circumstances, and the coefficients α_{ij} describe i's attitude towards person j; see, e.g., [8] and references therein.

For collective decision making, the optimal solution – according to decision theory – is to maximize the product of utilities; this is known as *Nash's bargaining solution*; see, e.g., [5, 6, 7].

Let us apply decision theory to our situation. Let us consider a simplified situation, in which we have two persons: the main Person 1 and another Person 2 who starts expressing interest in Person 1.

We want to describe how this interest affects the happiness of Person 1. In general, according to decision theory, this happiness is determined by the overall decision a. In general, the state of each system – and, in particular, each decision – can be described by providing numerical values of all the characteristics describing this state or this decision. So, in mathematical terms, each decision can be described by a tuple of the corresponding numerical values $a = (a_1, \ldots, a_k, \ldots)$.

At first, before the interest starts, the collective decision f is determined by maximizing the product of the utilities of these folks:

$$u_1(f) \cdot u_2(f) = \max_a u_1(a) \cdot u_2(a). \tag{1}$$

Once the Person 2 starts getting positively interested in Person 1, the utility of Person 2 changes from its original value $u_2(a)$ to the new value $u_2(a) + \alpha \cdot u_1(a)$ for some positive number $\alpha > 0$. We consider the case when this interest is mostly professional, so its intensity is not high: $\alpha \ll 1$. Since the utility of Person 2 changes, the collective solution also changes, now we select an alternative s that maximizes the product of new utilities:

$$u_1(s) \cdot (u_2(s) + \alpha \cdot u_1(s)) = \max_a u_1(a) \cdot (u_2(a) + \alpha \cdot u_1(a)). \tag{2}$$

In these terms, the Hawthorne effect means that this interest makes Person 1 happier, i.e., that

$$u_1(s) > u_1(f). \tag{3}$$

Let us see if we can explain this effect.

Towards an explanation. According to calculus, the fact that the expression (1) attains its maximum for $a = f$ means that the derivatives of this expression over all components a_k of a are equal to 0:

$$\frac{\partial(u_1(a) \cdot u_2(a))}{\partial a_k}\bigg|_{a=f} = 0. \tag{4}$$

At the point $a = f$, the derivative d_k of the new objective function

$$u_1(a) \cdot (u_2(a) + \alpha \cdot u_1(a)) = u_1(a) \cdot u_2(a) + \alpha \cdot (u_1(a))^2 \tag{5}$$

with respect to the component a_k is equal to

$$d_k \stackrel{\text{def}}{=} \frac{\partial(u_1(a) \cdot (u_2(a) + \alpha \cdot u_1(a)))}{\partial a_k}\bigg|_{a=f} =$$

$$\frac{\partial\left(u_1(a) \cdot u_2(a) + \alpha \cdot (u_1(a))^2\right)}{\partial a_k}\bigg|_{a=f} =$$

$$\frac{\partial(u_1(a) \cdot u_2(a))}{\partial a_k}\bigg|_{a=f} + \frac{\partial\left(\alpha \cdot (u_1(a))^2\right)}{\partial a_k}\bigg|_{a=f}. \tag{6}$$

At the point $a = f$, the first term in the sum (6) is, according to the formula (4), equal to 0, so

$$d_k = \frac{\partial}{\partial a_k} \left(\alpha \cdot (u_1(a))^2 \right)_{|a=f} = 2\alpha \cdot u_1(f) \cdot \frac{\partial u_1(a)}{\partial a_k}_{|a=f}. \tag{7}$$

Depending of the sign of the last derivative in the formula (7), we have two possible cases: either this derivative is positive (or, strictly speaking, non-negative) or it is negative. Let us consider both cases one by one.

Case when the derivative is positive. Let us first consider the case when the derivative is positive, i.e., when

$$\frac{\partial u_1(a)}{\partial a_k}_{|a=f} > 0. \tag{8}$$

Since $u_1(f) > 0$ and $\alpha > 0$, this means that the derivative d_k is also positive – so, if we increase the value a_k, we get a larger value of the product of the utilities. So, to get to the new maximum s, we need to increase a_k.

In this case, due to (8), the value of the utility $u_1(a)$ will also increase – i.e., in commonsense terms, Person 1 will be happier in the new state s than in the original state s.

Case when the derivative is negative. Let us now consider the case when the derivative is negative, i.e., when

$$\frac{\partial u_1(a)}{\partial a_k}_{|a=f} < 0. \tag{9}$$

Since $u_1(f) > 0$ and $\alpha > 0$, this means that the derivative d_k is also negative – so, if we decrease the value a_k, we get a larger value of the product of the utilities. So, to get to the new maximum s, we need to decrease a_k.

In this case, due to (9), the value of the utility $u_1(a)$ will also increase – i.e., in commonsense terms, Person 1 will be happier in the new state s than in the original state s.

Conclusion. In both cases, the mere fact that Person 2 starts expressing interest in Person 1 increases the happiness level of Person 1 – which is exactly the Hawthorne effect.

Thus, this seemingly counter-intuitive effect indeed naturally follows from decision theory.

Acknowledgments

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