Quantifying Love

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There is much work in the literature that assumes a known quantification of love (”you don’t love me enough”, ”you love her more than you love me”, etc...). This papers attempts to quantify the term ”love”.

Let P be a set of love-capable agents [1] and U be a set of variables. The variables in U need not be of any one domain (”money in bank account X” and ”person Y’s physical well being” are examples of such variables). A state s is an assignment to every variable in U. Let S denote the set of states. A ”happiness function” is a function $\phi : S \to [0, 1]$. For simplicity, we take the set of time points to be the discreet $\mathbb{N}$, although other choices such as $\mathbb{R}$ could be justified as well. The target $[0, 1]$ was chosen to simplify comparison between different people’s happiness function.

We assume that for every person p, his goal in life is to maximize the expression $\Phi_p \triangleq \Sigma_{t=0}^{T} \phi_p(s_t)$, where T is his moment of death, ϕ_p is his happiness function, and $\{s_0 \ldots s_T\}$ are the states during his lifetime (we choose $t = 0$ as the moment of his birth). It can be argued that a person’s happiness function may change over time - for example, he may like apples and hate oranges when he is young, and switch tastes when he gets older. We don’t investigate this point further and assume that it if at all, the happiness function changes only very slowly, and is considered fixed in our analysis.

The universe U can be decomposed into U^I, the internal variables (including a person’s well being, sense of taste, bank account) and U^E, the external variables relative to person p. A state s_t is similarly decomposed into s_t^I and s_t^E We will assume such a decomposition of U into external and internal variables exist, though defining one might not be an easy problem. Furthermore, we assume a composition function f_p exists, so that $\phi_p(s_t) = f_p(\phi_p^I(s_t^I), \phi_p^E(s_t^E))$, and f_p is a monotonically increasing function.

Let $\phi_{(p,q)}$ be p’s estimates on q’s happiness function. That is, $\phi_{(p,q)}$ is $p's$ approximation of ϕ_q. We define a person’s *love function* as a function $l_p : P \setminus \{p\} \to \mathbb{R}$ so that $\phi_p^E(s_t^E) = \Sigma_{q \neq p} l(q) \phi_{(p,q)}(s_t)$. We assume here that the external happiness ϕ_p^E is determined solely by the happiness function of all other people, though this could be extended to include other factors as well. Note that for a given other q, if $l_p(q) = 0$ then p does not care at all about q’s happiness,

[1] we will focus our discussion on people, but other entities are assumed to be able to show ”love” as well

and if $l_p(q) < 0$ then p likes it when he thinks q suffers. For most people p and q, $l_p(q)$ is very nearly 0, as there is very little interaction (perhaps maybe for Jesus Christ or other saints it is different).

Cooperation is a useful strategy in maximizing Φ_p. Suppose $l_p(q) \geq 0$, and let's say p thinks q is reliable, regardless of his other properties. And let us say p at moment t can choose between two different actions A and B. Let S_A be the state if A is taken, and S_B be the state if B is taken. Suppose $\phi_p^I(A) < \phi_p^I(B)$ and $\phi_(p,q)(A) - \phi_(p,q)(B) > \phi_p^I(B) - \phi_p^I(A)$. Then by choosing to take action A over B, p ensures q's happiness increases by more than his own would by choosing A. If at some later point t' person q does the same, the overall benefit for both p and q is greater than by greedily choosing the currently better option B. Note that if p hates q and $l_p(q) < 0$, this may no longer be a wise strategy - helping q might lower p's own happiness further, does making the deal a non profitable one. On the other hand, if $l_p(q) >> 0$ (for example, $l_p(q) = 0.5$), then it might benefit p to help q even at a great personal expense, and not just for the promise of future rewards. p benefits from helping q because he feels happier when q is, so part of the cost on p's part is negated by this.

If $l_p(q) = 1$, then p values q's happiness as much as their own. Examples exist when $l_p(q) > 1$, for example mothers are known to suffer for their babies - of course enjoying it overall because the positive effect of their babies' happiness on their own. Pathological cases of $l_p(q) >> 1$ are considered psychologically unhealthy, as p cares more for q than for himself and will be severely disappointed if his love function change later on, because his own personal happiness ϕ_p^I is presumably very low because of altruistic choices he has made to increase q's happiness. Another danger is a bad approximation of l_q by p. If $\phi_(p,q)$ is very different from ϕ_p, then the described strategy of mutual helping will fail, as q will not feel inclined to help p since p's actions increased $\phi_(p,q)$ but not ϕ_q. It would be interesting to find if friends and acquaintances have l somewhere around 0.5 or some other number roughly in the middle of $[0,1]$. This author consider an ideal relationship of any kind to have $l = 1$, where one considers the other person's happiness just as highly as he considers his. That ideal is probably hardly ever realized in this world, but one can still hope.