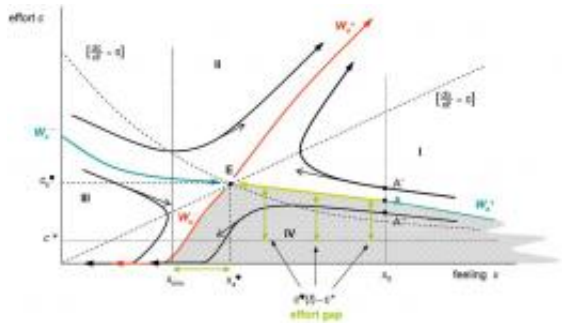
Mathematical model explains marital breakups

May 17 2010, by Lin Edwards



Durable relationships. Under the assumptions of the model, there is a unique effort policy that takes the initial feeling x0 to the unique equilibrium E. This is achieved by setting the initial effort at point A to get onto the stable manifold Ws+ and then following path AE to approach equilibrium. Image credit: PLoS ONE, doi:10.1371/journal.pone.0009881. See the paper for more details.

(PhysOrg.com) -- Most people know love takes work, and effort is needed to sustain a happy relationship over the long term, but now a mathematician in Spain has for the first time explained it mathematically by developing a dynamical mathematical model based on the second law of thermodynamics to model "sentimental dynamics." The results are consistent with sociological data on marriage breakdowns.

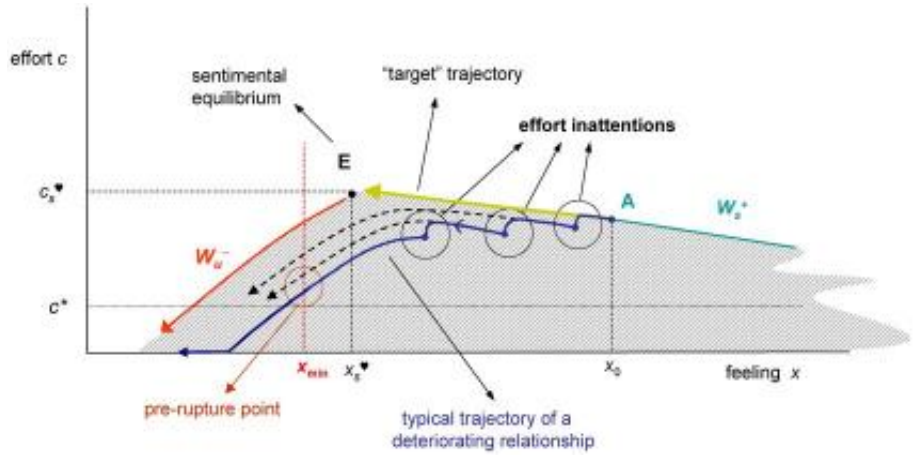
Most couples marry only after careful consideration and most are determined to make their marriage last, and a happy marriage is widely considered in Western societies to be important for overall happiness.

Yet soaring divorce rates and break ups of de facto relationships across Europe and the U.S. show these plans and ideals are failing. Many scholars attribute the increasing rates of breakdown to economic forces and changes in sexual divisions of labor, but this does not fully explain the continuing rise in those rates.

The research was carried out by José-Manuel Rey of the Department of Economic Analysis, at the Universidad Complutense in Madrid, and aimed to provide a mathematical model to explain rising rates of marital breakdown. Using the optimal control theory model, Rey developed an equation based on the "second thermodynamic law for sentimental interaction," which states a relationship will disintegrate unless "energy" (effort) is fed into it.

The results of the mathematical analysis showed when both members of union are similar emotionally they have an "optimal effort policy," which results in a happy, long-lasting relationship. The policy can break down if there is a tendency to reduce the effort because maintaining it causes discomfort, or because a lower degree of effort results in instability. Paradoxically, according to the second law model, a union everyone hopes will last forever is likely break up, a feature Rey calls the "failure paradox".

According to the model, successful long-term relationships are those with the most tolerable gap between the amount of effort that would be regarded by the couple as optimal and the effort actually required to keep the relationship happy. The mathematical model also implies that when no effort is put in the relationship can easily deteriorate.



Breakup mechanics. The model produces a plausible scenario, through a sequence of effort inattentions, for the deterioration of a relationship in a gradual form, which seems to be typical according to data. Because of the effort gap, there is a tendency to lower the right effort level. Then the intrinsic instability of sentimental dynamics obeying the second law causes the piecewise decaying trajectories to move further and further away from the target trajectory and eventually to cross the threshold level xmin. This is considered a point of pre-rupture, since it is a matter of time before effort is abandoned. Credit: PLoS ONE, doi:10.1371/journal.pone.0009881

The mathematical model may help explain why couples split in real-life scenarios, and adds to our understanding of how and why relationships go wrong. Having a better understanding of this can help us to work out how to make the relationship improve, which is helpful because broken relationships pose major sociological, economic, and other problems in our society. The study is also a reminder it is better to work on the relationship when the going is good, instead of relaxing and then finding the increased work necessary to fix a disintegrating relationship is more than considered reasonable.

The paper is published and available online at *PLoS ONE* and is dedicated to "the unique long-standing sentimental equilibrium of Pepe

Rey and Ana Simó".

More information: Rey J-M (2010) A Mathematical Model of Sentimental Dynamics Accounting for Marital Dissolution. PLoS ONE 5(3): e9881. doi:10.1371/journal.pone.0009881