

# A Cybernetic Approach to Controlling Health Problems

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Over the past few decades, health problems have been increasing by more than 8.5% every year [1]. According to a recent study by center for Disease Control and Prevention, 65% of US adults are either overweight or obese. Diabetes rates are shooting up in the United States, with a 27 percent increase in last 5 years. At least 250,000 million people die of heart attack each year. Health care cost poses a major threat to the nation's economy. However, health problems can be mitigated to a large extent by *regulating* people's lifestyle. *Conversation/Communication* in a group/friend may help people to adopt a healthy lifestyle. Therefore, Cybernetics being the study of *conversation/communication* and *control/regulation* [2] can be used to helping solve this problem. This effort aims at developing cybernetics model for controlling health problems.

## **Addiction**

In developed countries like USA, where the literacy rate is more than 95%, people know that adopting a healthy lifestyle eliminates the risk of chronic health problems to a large extent. However they do not follow a healthy lifestyle. Why? The answer is that people are *addicted* to an unhealthy lifestyle. For example- people are addicted to sleeping in the couch and that is why they do not exercise. People are addicted to eating high calories food that makes them obese and prone to heart problems. Addiction is a condition in which the desire/craving to repeat an addicted behavior consistently exceeds the ability to stop doing so [3]. When the more you have, the more you need to achieve the same effect. This effect can be modeled as a positive feedback loop where the desire keeps increasing in a loop.

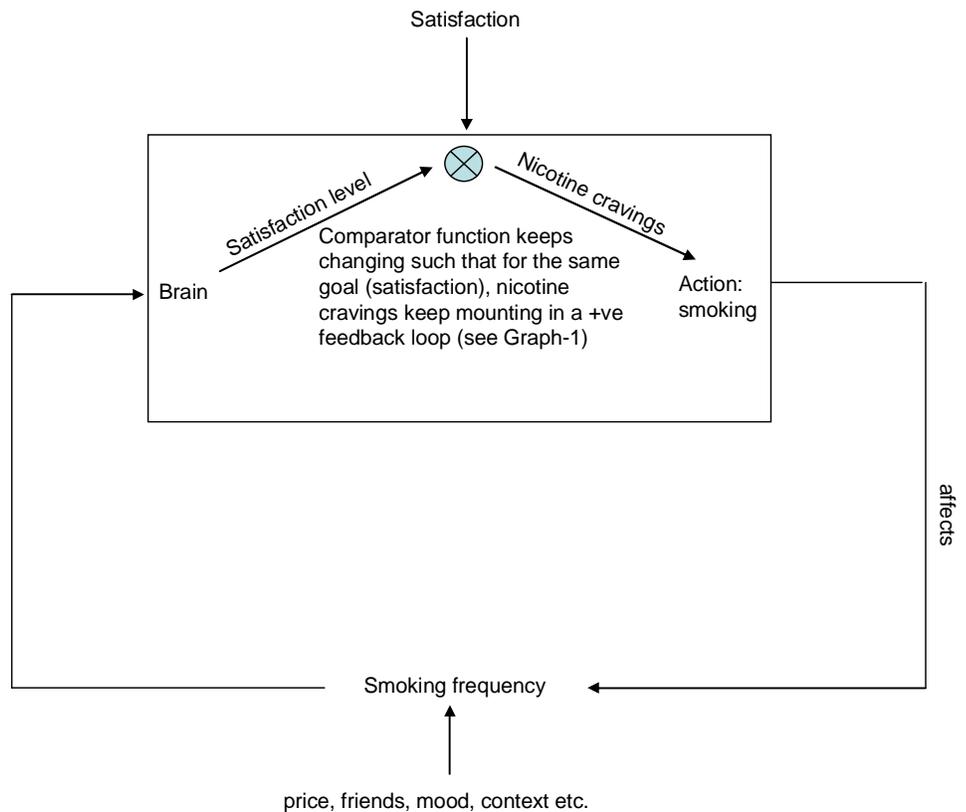
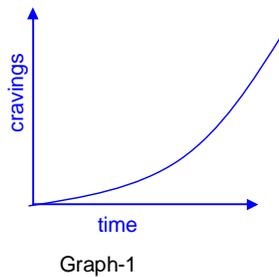
Some background about feedback loops – Feedback loops are of two forms: negative feedback loop and positive feedback loop. Negative feedback loops move towards balance and stasis by subtracting error with each cycle. A classic example of negative feedback loop is homeostasis, the body's system for keeping itself chemically and temperature balanced. Positive feedback loops, by comparison, add the variations of each cycle. As a result they can become dangerous as their effect mount with each event. Hypothermia, shock, heatstroke are examples of positive feedback [4].

Figure-1 models addiction (nicotine addiction) as a positive feedback. The desire for smoking keeps growing in the loop for achieving the same satisfaction. The first day, Bob needs to smoke once for getting satisfied. The second day, he needs to smoke twice for getting satisfaction. Gradually, his craving to smoke and in turn smoking frequency keeps increasing.

### Addiction (uncontrollable)

(When the more you have, the more you need to achieve the same effect)

#### +ve Feedback

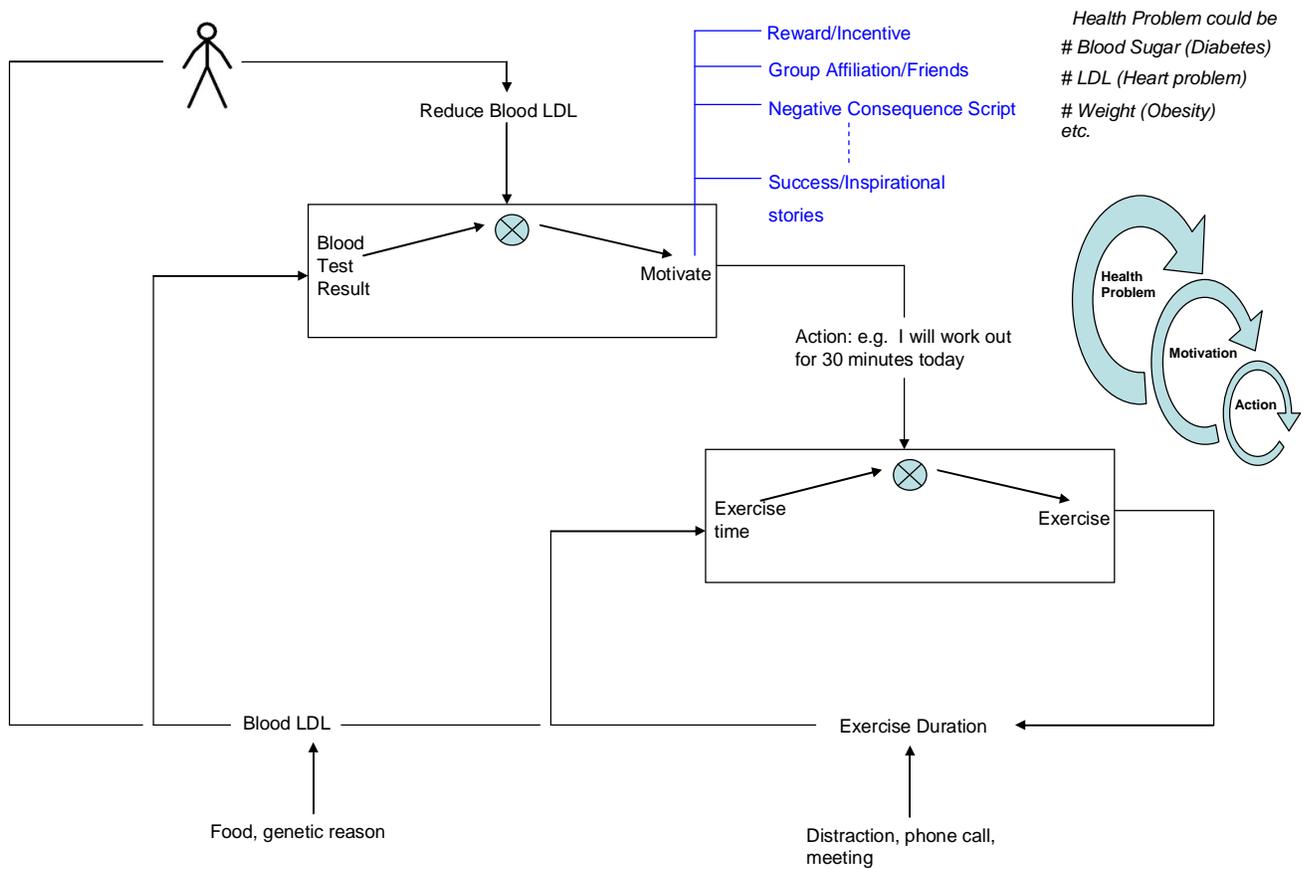


**Figure 1: Addiction as a positive feedback (uncontrollable)**

### Controlling Uncontrollable (addiction)

Above diagram (Figure-1) shows how cravings keep mounting in a positive feedback loop. In addition, Bateson’s analysis of alcoholism argued that the very attempt to regain self-control, to be a “captain of one’s own soul”, contributed to the escalation of the alcoholic process [5]. Furthermore, the Twelve Step Program of Alcoholics Anonymous—which has been successfully adapted to so many different addictive behaviors, offers recovery by “surrendering” that is, by ceasing to spend conscious effort to control addiction [6]. Hence, the addict does not have a requisite variety to control addiction.

When Addiction is an uncontrollable event, how to control it? Ludwig’s study on Alcoholics mind shows that “developing the proper frame of mind” (adequate motivation) for sobriety increases the likelihood that an individual can learn to resist his craving [7]. To some extent, AA also works on the same principle-“developing the proper frame of mind”, by the “prayer script” and group affiliation. The success of Weight Watchers also depends on how well the system can motivate an individual for eating low calorie food and exercising regularly [8]. In conclusion, adequate motivation can solve the mystery of addiction as an uncontrollable event. The diagram below shows the cybernetic approach to controlling health problems by motivating people for following a healthy lifestyle (exercise, yoga, healthy food etc.), that is abstinence from unhealthy lifestyle.



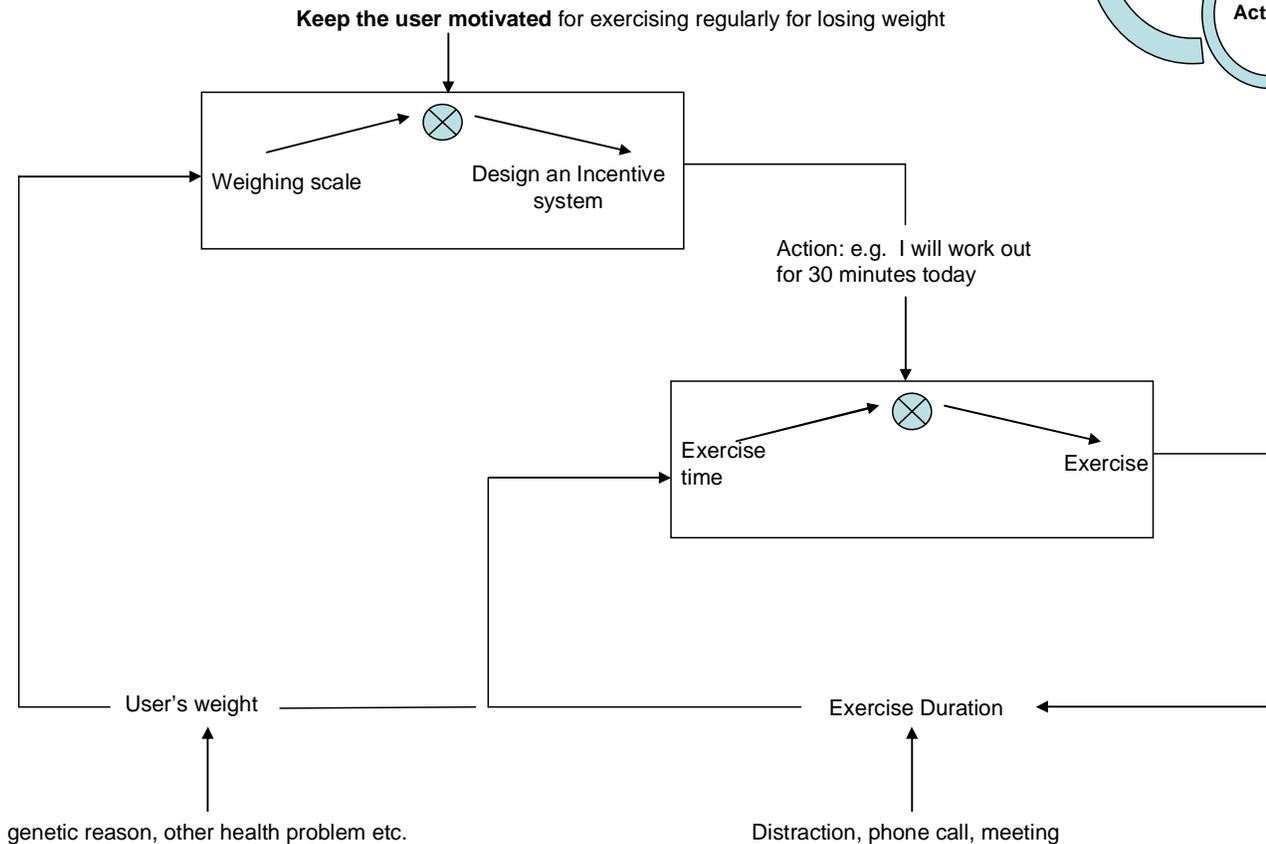
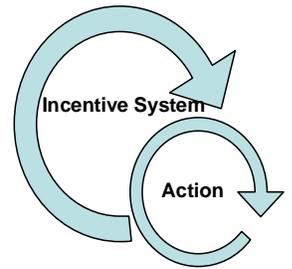
**Figure 2: Motivation script for Controlling Uncontrollable**

## Reward/Incentive System

People have various needs including monetary needs, physiological needs, safety needs and esteem needs [9]. A system/principal can motivate an agent for performing an activity by giving proper incentive to the agent such that the incentive may help the agent in fulfilling some of his needs. Here a system could be a web application like Weight Watchers or a system could be an organization such as a health club. Below is a model of an incentive system for motivating an agent for exercising regularly. The model also shows that the principal can keep refining or modifying the incentive system for making sure that the agent is always motivated.

### Reward/Incentive System

- Monetary needs
- Physiological needs
- Safety needs
- Esteem needs etc.



**Figure 3: Reward/Incentive system**

## **Group Affiliation/Friends**

Group, friends and family help in controlling addiction and regulating lifestyle. People develop trust, care and similarity in a group that provide mental strength for controlling their cravings. It has also been proved that the group affiliation programs provide long-term treatment for addiction as compared to short-term treatment provided by medication therapy. Self-Help programs like Alcoholics Anonymous, Rational Recovery or Women for Sobriety, help in gaining control over addiction by helping the patient integrate into a self-help group [10, 11, 12]. The increasing success of Minnesota Model of Treatment also lies in group affiliation model of 12-steps of AA [13]. Following sections provide conversation model of how trust, care and similarity in a group/friend/family motivate for abstinence.

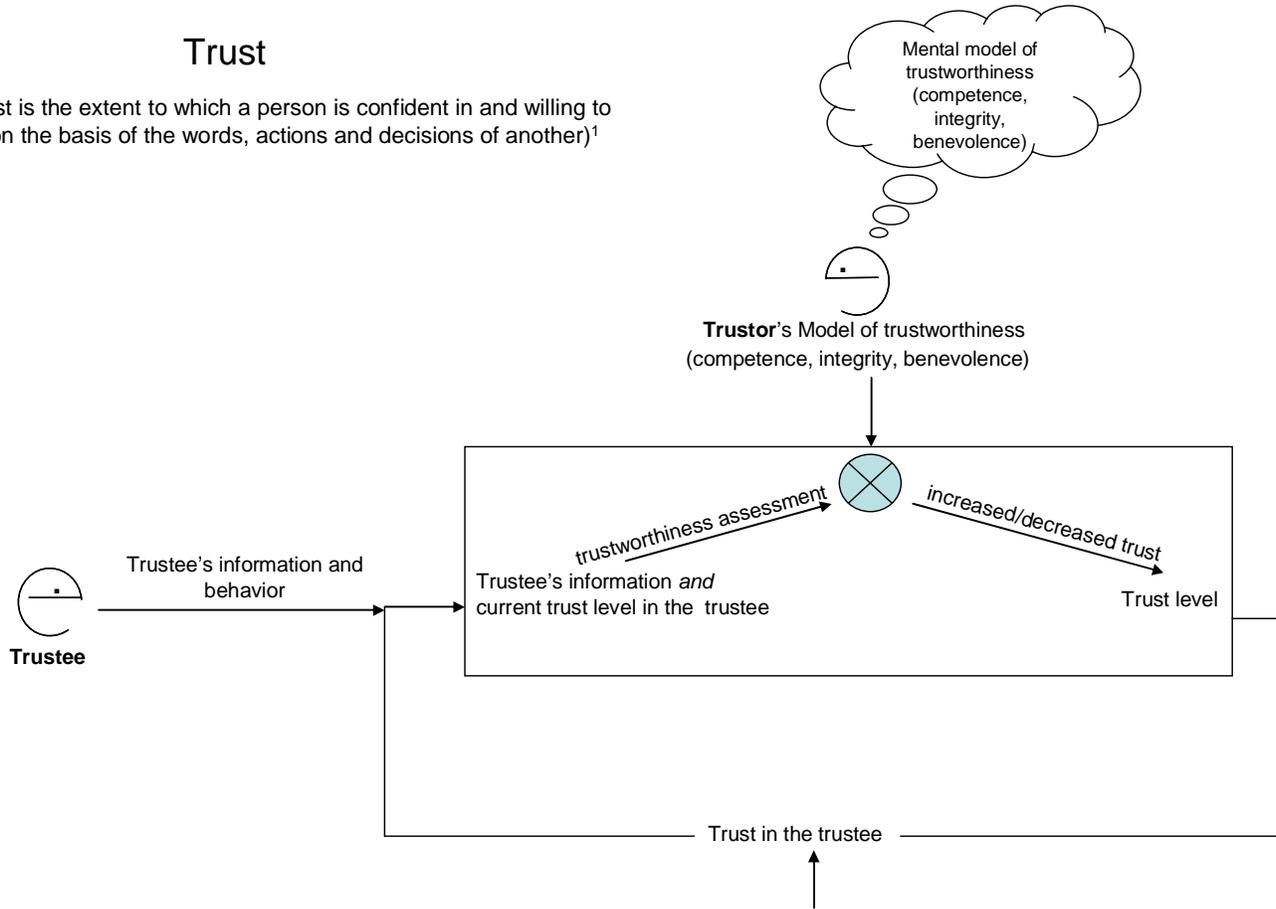
## **Trust**

Trust is a system-related concept and that is continuously evolving state of information gathering, processing and feedback [14]. Figure-4 represents the system model of trust between two actors (trustor and trustee). The trustor is continuously assessing the behavior of the trustee against his mental model of trustworthiness, resulting in increased trust if the behavior matches with his mental model otherwise decreased trust. Trustworthiness depends on three variables which relate to perception about the individual to be trusted: competence, integrity and benevolence [15]. 'Competence' is the perceived ability of trustee, as measured by indicators such as education or credentials, experience, and reliable past performance. 'Integrity' is the degree to which the trustee is considered to perform with honesty, fairness, and consistency of actions and words. 'Benevolence' concerns the extent to which the trustee demonstrates care and consideration for individuals her or she interacts directly or indirectly.

In addition to above identified antecedent variables, trust also depends on 'context' within which the trustor and trustee are embedded [16]. It may affect the extent to which the trustee is rated on antecedent variables especially competence. For example, a person may be perceived as competent in one context but not in another. Furthermore, it is important to distinguish between interactions among unfamiliar others and ongoing interactions among familiar others for trust [17].

# Trust

(Trust is the extent to which a person is confident in and willing to act on the basis of the words, actions and decisions of another)<sup>1</sup>



**Figure 4: Trust as continuously evolving state of information gathering, processing and feedback**

1. <http://hum.sagepub.com/cgi/reprint/54/8/1045.pdf>

In a social system, trust could be unidirectional or bi-directional. Also, trust may be commutative

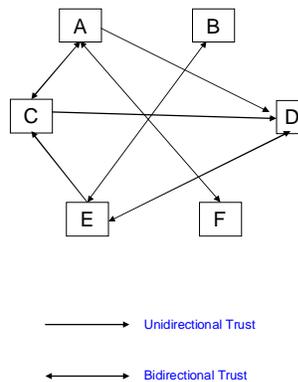
## A social system

- Can trust be unidirectional?

Answer: YES

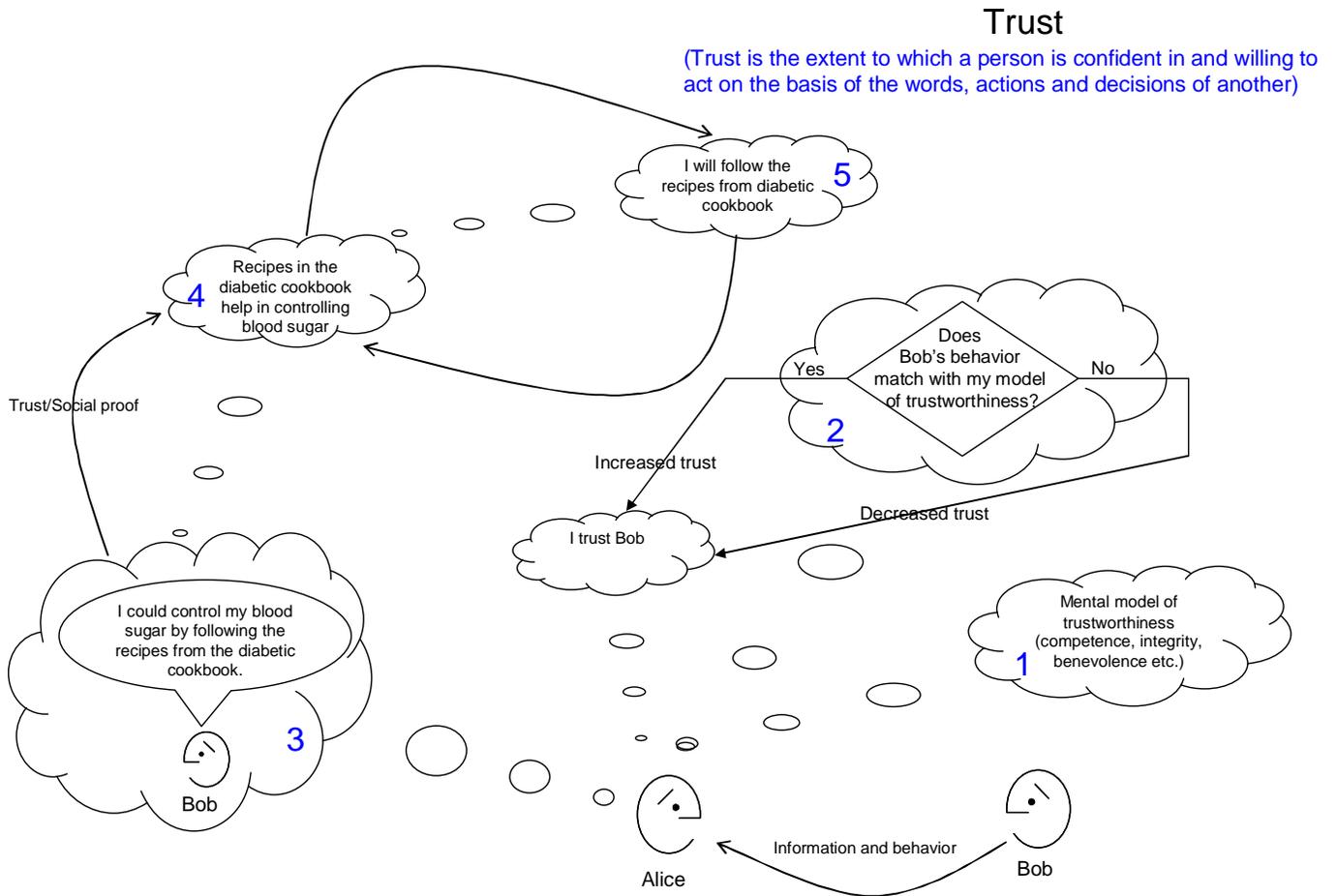
- Is trust commutative?

Answer: May be



**Figure 5: Trust in a social system**

When trust is developed, the trustor (Alice) is confident and willing to act on the basis of the words, actions and decision of the trustee (Bob) to an extent proportional to the trust level in the trustee. Now, when Bob says that he could control his blood glucose by following the recipes from the diabetic cook-book, Alice is confident that the recipes in diabetic cook-book works and she is motivated to follow them. It also gives her social proof of the reliability of recipes from the diabetic cook-book. Figure-6 is the conversation model of this trust and social proof scenario between Alice and Bob.

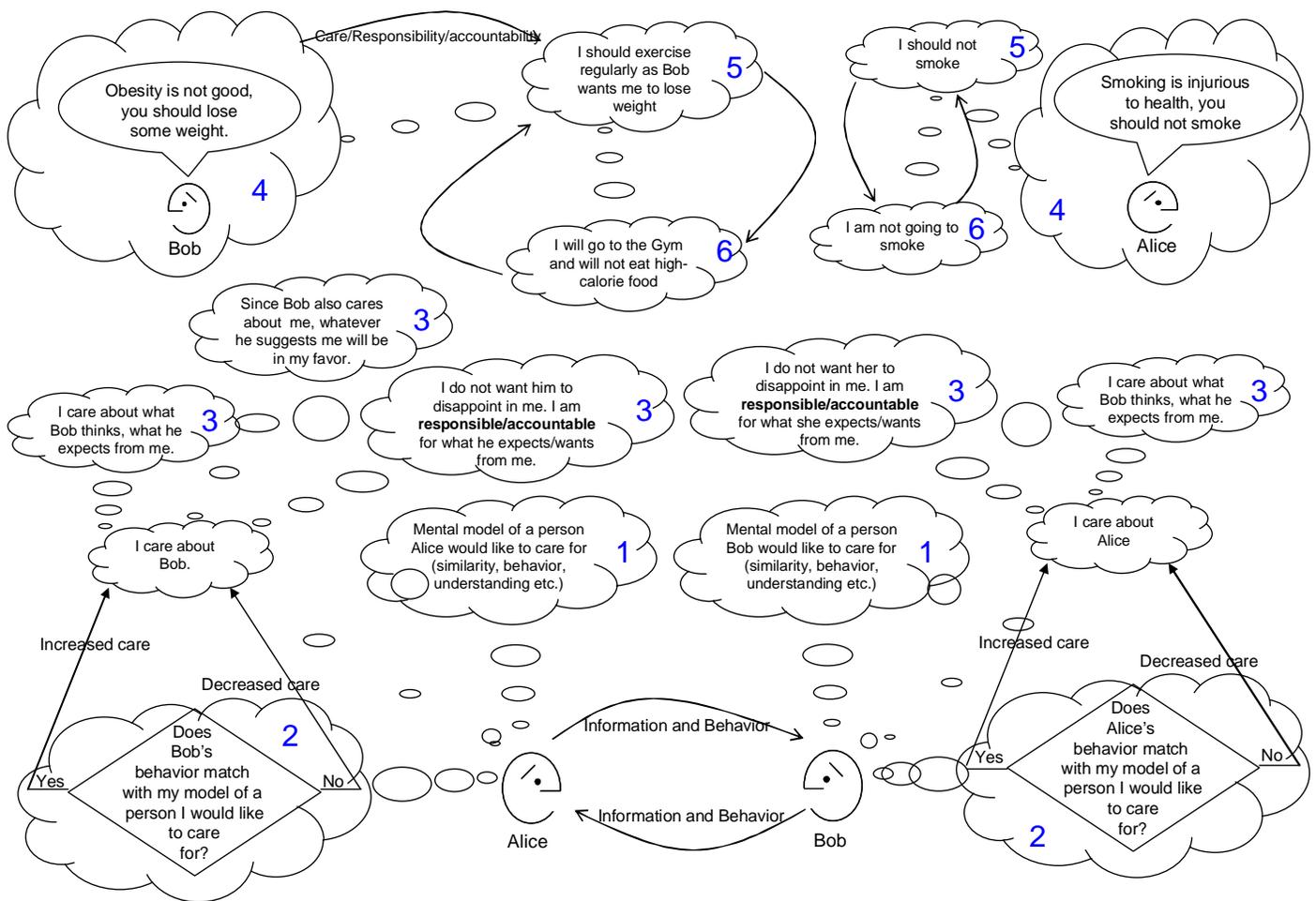


**Figure 6: Trust/Social Proof in a self-help system**

### Care

Similar to trust, care is continuously evolving state of information gathering, processing and feedback. The antecedent variables for care may include similarity, trust, understanding and reciprocity. It also depends on context and familiarity/relationship between the agents. Below figure shows a model of care between Alice and Bob and how care helps them for abstinence. Alice matches Bob's behavior with her mental model of a person she would like to care for. If Bob's behavior matches with Alice's mental model

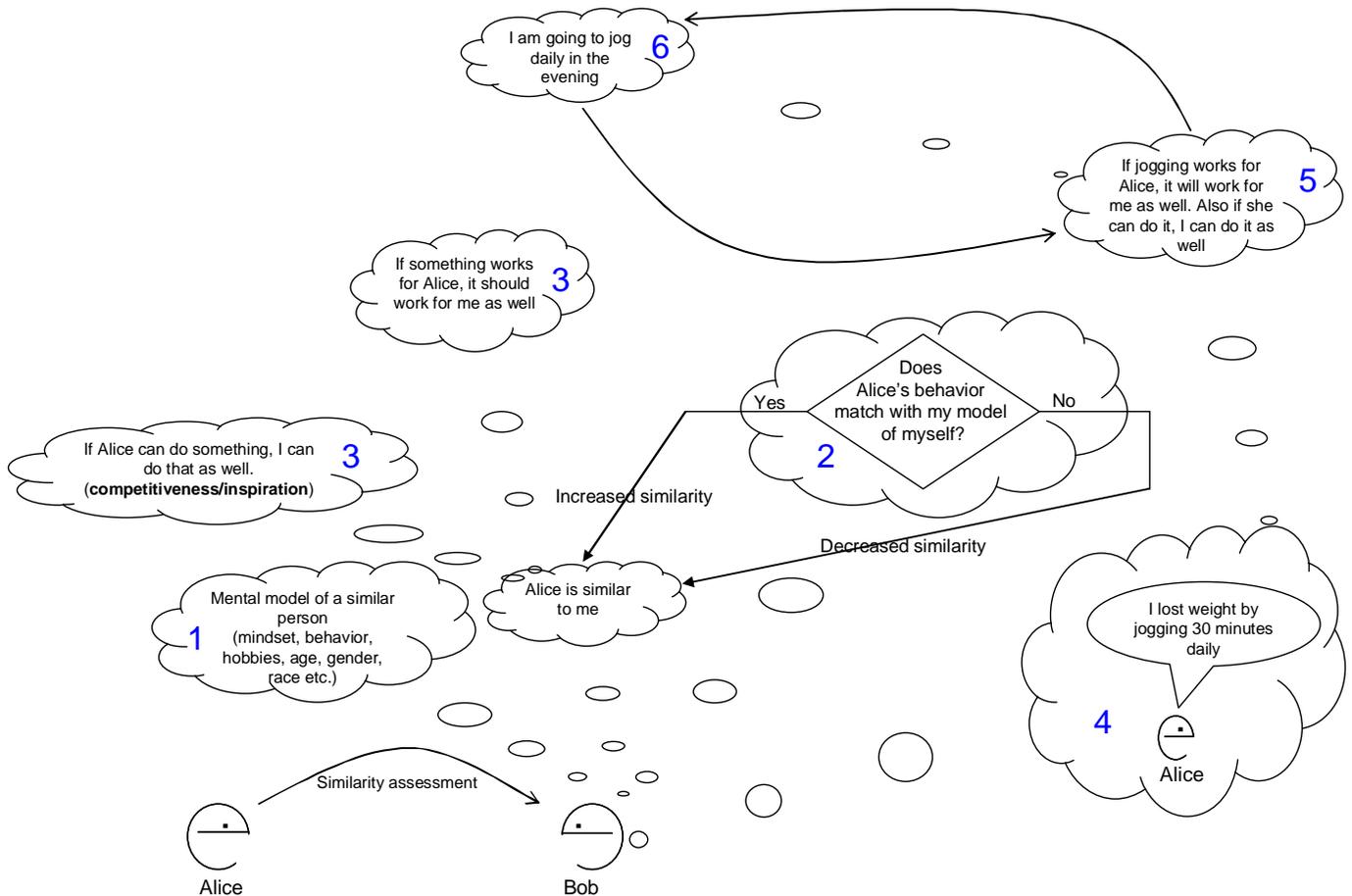
of a person she would like to care for then the care for Bob is increased otherwise decreased. When Alice cares about Bob, she cares about what Bob expects from her. She feels responsible/accountable for what Bob expects from her because she does not want to disappoint him in her. Similar thing happens as Bob side where he does behavior assessment of Alice against his mental model of a person she would like to care for. The important point that is that the Bob's mental model of a person he would like to care for may be different from Alice's mental model of a person she would like to care for. Also, care may be unidirectional as well. Now when Bob suggests Alice that she should lose weight, she feels responsible/ accountable for losing weight as she cares about Bob. Similarly, Bob feels responsible/accountable for not smoking when Alice asks her to quit smoking.



**Figure 7: Care/Accountability/Responsibility**

## Similarity

Same as trust and care, similarity is continuously evolving state of information gathering, processing and feedback. The antecedent variables for similarity may include mindset, behavior, hobbies, age gender and race. Below figure shows how similarity motivates Bob for exercising regularly because he gets competitive and inspired by Alice.



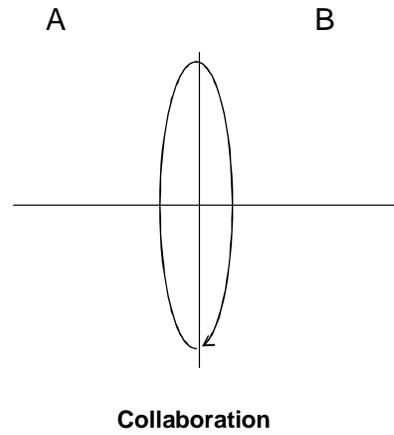
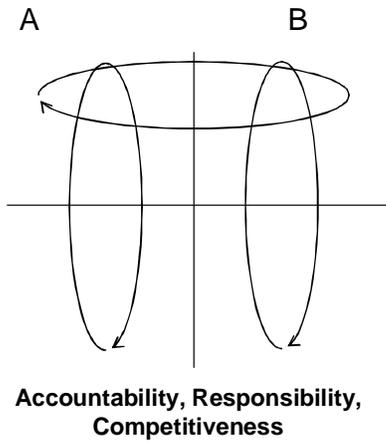
**Figure 8: Similarity/Competitiveness/Inspiration**

Below table summarizes Trust, care and similarity.

	Antecedent Variables	Motivation
Trust	Competence, Integrity, Benevolence	Willing to act on the basis of words, actions and decisions of another
Care	Similarity, Understanding, Trust, Reciprocity	Accountability, Responsibility
Similarity	Mindset, hobbies, age, gender, race	Competitiveness, Inspiration

**Figure 9: Summary for Trust, Care and Similarity**

Alternative model for Accountability, Responsibility, Competitiveness and collaboration in a self-help group:



**Day-1: A and B together at home**

A Lets stop eating cookies so that we can lose weight.  
 B: Sure! Lets do that.

**Day-2: A in his office and B in her office**

A: Free Cookies! But I have given words to B that I will not eat cookies. (*accountability, responsibility*)  
 B: Free Cookies! But A is losing weight by not eating cookies, so I should not do eat them as well. (*competitiveness*)

A and B decides to go to the gym together daily in the evening. They get each other's companionship and some time to socialize together.

A: Its 5 o'clock. I am coming to pick you up for going to the gym together.  
 B: Sure! I am waiting for you.

**Figure 10: Accountability, Responsibility, Competitiveness and Collaboration**

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