Risk based Personal Trust Test - Method for Calculating Overall Trust in Personal Relationships

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Abstract: *The paper proposes a novel risk based trust test system that can be modeled using an Artificial Intelligence (AI) system. The test can be used to carry out the trust test between individuals using AI based system. The paper is based on a real-life experiment to understand the important trust traits in a personal relationship. Based on the key influencing trust traits, we identified the five key trust traits that influence inter-personal trust. We also did an experiment to quantify the impact of each of the 5 trust traits on the overall trust and defined trust trait calculation formula based on the findings of the experiment. The paper proposes 5 main trust traits: Confidence, Intent of action, Faith, Track record, personal affection and various sub attributes for the main trust traits. The main traits and sub traits can be used for carrying out the personal trust test as proposed by the model. The paper provides a risk based trust scoring system that calculates the overall trust score based on Confidence, Intent of action, Faith, Track record, personal affection and various sub attributes for the main trust traits. The paper can be used for personal trust score calculation between individuals.*

Keywords: Software Engineering, Trust Model, Artificial Intelligence, social engineering, Interpersonal trust

1. Introduction

Study of interpersonal trust is an important part of software models. Social media platforms and other digital platforms (such as professional connection platforms, online communities, and online interest based groups) all succeed only if the individual users in the group have high trust quotient.

Interpersonal trust among social settings is an area that needs to be researched. In this paper we have defined a personal trust test model and elaborated on how to identify the key traits of interpersonal trust. We have carried out a real world experiment to quantify the impact of identified trust traits. Based on the results of 2-week long experiment we have defined the formula for calculating each of the trust traits and the overall trust value in an interpersonal relationship.

The formal definitions of trust traits and overall trust definition can be used in social media platforms and AI-based platforms (such as chatbots, virtual assistants) to assess the trust value between two digital personas.

Paper organization
In the remaining portions of the introduction section we will look at state of the art methodsin the interpersonal trust. We will discuss the complete details of the "Personal trust test"in the "Method" section. In "Results" section we will look at the findings of the real world experiment.Finally, we will discuss the results,threats to validity and future scope of improvements in "discussion" section.

2. Literature Review and Related work

Jeffry discuss the key foundations of trust (2007). The main trust models in literature are surveyed below. In dispositional view a person-centered trust is studied (Deutsch, 1973) and it involves core belief and attitudes about the degree to which other people are likely to be reliable, cooperative, or helpful in Experimental game

situations. In dyadic view, interperson view is studied and in this model trust is a psychological state or orientation of an actor (the truster) toward a specific partner (the trustee) with whom the actor is in some way interdependent (that is, the truster needs the trustee's cooperation to attain valued outcomes or resources).

The dyadic model of trust (Simpson, 2007) includes these steps: two individuals enter a trust relationship or trust test situation. This provides an oppurtunity to make joint decisions and and based on motives and mutually beneficial joint decisions they create positive emotions and expectations. This further leads to trust perceptions and sense of security.

McKnight, Larry and Norman study the initial formation of trust in an organization context (1998). Finkel, Paul and Simpson discuss 14 core principles of close relationships as Uniqueness, Integration, Trajectory, Evaluation, Responsiveness, Resolution, Maintenance, Predisposition, Instrumentality, Standards, Diagnosticity,Alternatives, stress and culture.

3. Method

In this paper we have proposed a new trust test model that can be used to assess and define the main trust traits. Once the trust traits are identified we quantify their impact on the overall trust value.

High level steps used in the "Normalized sprint estimation" are as follows:
1) Identify a subject of high trust among close relationships
2) Create a sudden event of distrust for the selected subject to create a trust test:
   a) Let the subject plant a recording device in an obvious place.
   b) Plant the recording device in an obvious place so that it will be discovered leading to conflict of trust relationship of the subject among close relatives.

3) Record and document the behavior among close relationships over a period of 2-3 weeks till research questions are answered.

This experiment setup creates a sudden trust deficit among the close relationships which helps us to monitor the attitude and strained relationship value.

In the coming sections we will elaborate the calculation for each of these parameters.

4. Result

Given below are the observations over a 10-day time period. A 7-point Likert-type scale is used to observe the reaction of 4 closely related family members:

Strongly Disagree	Dis Agree	Slightly Disagree	Neutral	Agree	Slightly Agree	Strongly Agree
-3	-2	-1	0	1	2	3

Overall test data on 7 point scale
I have recorded the test data for a 10 day time period. From this data I obtained the key points influencing the trust (Trust traits) in a quantifiable manner and validation of personal trust test. This data is used for validation of "Personal trust

Table 1: Overall data

Day-wise data	Event	Key trust traits	Comments	Trust level on 7-point scale			
				Close Relative	Related person 2	Related person 3	Related person 4
Day 1	Main event happened. Trust crisis on main subject. Main subject apologized and explained that the actual intent was not about recording	Negative: Betrayal, Trust breach, fear,	First reaction was that of disbelief, betrayal	1	0	-3	-3
Day 2	Close Relative wrote a reassuring mail	Positive: Faith, longevity of trust, Intent of action, Dependability, predictability, affection	Related person broke down	2	1	2	Not sure
Day 3		Positive: Loyalty, track record		3	1	2	Not sure
Day 4	Main subject wrote a mail offering normalizing relationship. Main subject offered apology to everyone	Negative: Stress, anxiety		3	2	3	0
Day 5				3	2	3	0
Day 6	Related person agreed for normalizing relationship	Positive: Faith, sincerity		3	2	3	0
Day 7		Positive: Confidence		3	2	3	0
Day 8				3	2	3	0
Day 9				3	2	3	0
Day 10		Positive: Commitment		3	2	3	0

Close Relative test data on 7 point scale:
Given below are reactions specific to Close Relative on 7-point scale.

Table 2: Close Relative specific data

Day-wise data	Event	Comments	7-point scale on trust traits			
			Faith	Disbelief	Dependability	Confidence
Day 1	Main event happened. Trust crisis on main subject. Main subject apologized and explained that the actual intent was not about recording		2	-1	1	3
Day 2	Close Relative wrote a reassuring mail		2	-1	1	3
Day 3			2	-2	2	3
Day 4	Main subject wrote a mail offering normalizing relationship. Main subject offered apology to everyone		2	-2	2	3
Day 5			2	-2	2	3
Day 6	Related person agreed for normalizing relationship		3	-2	2	3
Day 7			3	-2	2	3
Day 8			2	-2	1	3
Day 9		3	3	-2	1	3
Day 10		3	2	-3	1	3

5. Discussion

Given below is the weighted average value of positive and negative influencers of trust in personal domain. The values

were derived based on weighted average from table 1 and table 2 values.

Positive Influencers
- Confidence (weighted average 0.31)

- Intent of action (weighted average 0.22)
- Faith (weighted average 0.20)
- Track record (weighted average 0.17)
- Personal affection (weighted average 0.09)
- Predictability (weighted average 0.01)

Negative Influencers
- Betrayal (weighted average - 0.51)
- Trust breach (weighted average -0.41)
- Stress (weighted average -0.08)

Risk Based Personal Trust Test

Based on the positive and negative influencers for trust and scale data from table 1 and table 2, we can identify the key elements of risk based personal trust test. The main elements of risk based personal trust test is depicted below:
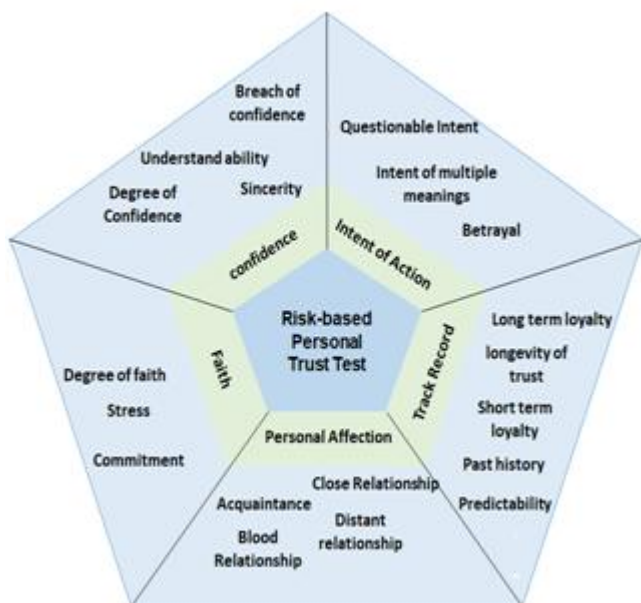

As depicted the five main pillars of risk-based personal trust test are as follows. The risk-based personal trust test can be designed to test various

a) Confidence: Confidence is one of the main trust traits. Confidence loosely amounts to the amount of belief of one person in another person. The risk based trust test should test the positive and negative aspects of confidence:
- Breach of confidence – an event to disprove the belief
- Understandability – an event to test how one person understands another

- Degree of confidence – an event to test the amount of belief
- Sincerity – an event to test the loyalty of the main subject

b) Intent of action: Intent is the main motive for any action. Create a test to question the motive and shake the trust with all positive and negative aspects of motives:
- Questionable intent: Create an event which looks questionable in its face value to test the trust and rational thinking behind the intent.
- Intent of multiple meanings: An event that leads to multiple and open interpretations.
- Betrayal: An event that appears as betrayal of trust

c) Faith: Faith is the blind belief in one person. Create negative scenarios to test the faith:
- Degree of faith – an event that test various degrees of faith
- Stress – A painful event that disturbs the established faith
- Commitment: - An event that questions the commitment

d) Track record: The age of trust is a key factor in trust test.
- Long term loyalty – chose a test subject with long term loyalty
- Longevity of trust – chose a test subject with various degrees of longevity
- Short term loyalty - chose a test subject with long term loyalty
- Past history - chose a test subject with past history of trust issues
- Predictability – chose a test subject with predictable and non-predictable behaviour

e) personal affection : This trust trait is more seen in closely knit interpersonal relationships:
- Acquaintance - Chose a test subject of frequent and infrequent acquaitanence
- Close relationship - Chose a test subject of close relationship
- Blood relationship - Chose a test subject of blood relationship
- Distant relationship - Chose a test subject of distant relationship

Once various test subjects and test cases are designed based on five pillars (Trust traits) as depicted in the diagram, we need to execute the risk-based personal trust test. Based on the result of experiment the method for executing the personal trust test is as follows:
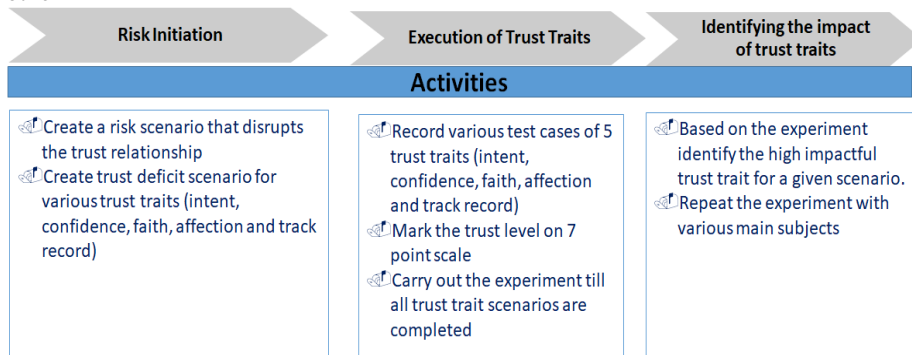
Formal definition of each of the trust traits
Use average value of 7-point scale for calculation

Confidence score calculation
Use the five attributes that contributes to confidence

$$Confidence_{Score} = Understandability_{Score} + Degree_{of_{confidence_{Score}}} + Sincerety_{Score} - breach\_confidence$$

Equation 1

Intent of action score calculation
Use the five attributes that contributes to intent of action

$$Intent_{action}e_{Score} = Questionalble_{intent_{score}} - betrayal\_score$$

Equation 2

Faith score calculation
Use the five attributes that contributes to faith

$$Faith_{Score} = Degree_{Of_{Faith_{Score}}} - stress_{score} + commitment\_score$$

Equation 3

Track record score calculation
Use the five attributes that contributes to faith

$$Track_{Record} = Longterm_{score} + Past_{History_{Score}} + Predictability\_Score$$

Equation 4

Personal affection score calculation
Use the five attributes that contributes to personal affection

$$Personal_{\_Affection} = Acquantiance_{Score} + Close_{Relationship_{Score}} + Blood_{relatiionship_{score}} + distant\_relationship\_score$$

Equation 5

Overall risk-based personal trust score calculation
Use the five attributes that contributes to personal affection

$$Personal_{Trust_{SCore}} = 0.22 * Intent_{action}e_{Score} + 0.20 * Faith_{Score} + 0.17 * Track_{Record} + Personal_{\_Affection} + 0.31 * Confidence_{Score}$$

Equation 6

6. Conclusion

In this paper we defined "Risk based personal trust test" that defines a novel method for identifying key trust traits that influenced the overall trust score. We carried out a real world experiment based on the above model and quantified the overall impact of each of the 14 trust traits on the trust value. We then used the quantified values to formally define the equations for trust traits and overall trust score.

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