

PSYREC: Psychological Concepts to enhance the Interaction with Recommender Systems

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Abstract. Although recommender systems are already a successful part of many online systems, there are still areas of research which are unexploited. One of them is the appropriate consideration of psychological theories which could be beneficial for the interaction between a computerized system and an online consumer, particularly in the financial services sector. This paper emphasizes the potentials of integrating psychological knowledge into the further development of recommender systems on the basis of psychological theories and basic decision processes. The enumerated concepts have been demonstrated to be influential in consumer buying behaviour in numerous studies and therefore are used as a theoretical basis of the presented work. A conceptual framework is build upon the technology acceptance model (TAM) which offers the possibility of integrating psychological knowledge in the further development of online financial services. Possible applications and implementations are shown on the basis of empirical work that has been carried out in the past years.

1 Introduction

The utility of recommender systems to enhance the quality of decision processes and their outcome has been approved many times, according to [1] they are among the most successful applications in Artificial Intelligence. Although recommenders have such a successful history, there are still unexploited potentials for advancement [2, 3]. Specifically promising in this regard is knowledge from psychology and research aiming to integrate it into recommender systems. This area of research is, taking the words of [4], still in its *infancy*. This paper opens new perspectives on the potentials of psychological concepts and theories to enhance the interaction with recommender systems in general and in the context of financial services in particular. The emphasis is put on interface and interaction aspects, because recommender systems are typically characterized by highly sophisticated algorithmic and technical basis. However, investigating also efforts in the enhancement of the interface is important, or, as Louis [5] formulated it: *"No matter how good your back-end systems are, the users will only remember your front end. Fail there and you will fail, period."*

The rest of the paper is structured as follows. In the first sections an introduction into the theoretical background with an emphasis on psychological concepts is given. This part is followed by a detailed discussion on decision phenomena and how these are related to recommender systems. Afterwards a framework based on the TAM, the *technology acceptance model* [6] is presented serving as a research basis for future research activities. In Section 6 studies which were

carried out and showing concrete possibilities for combining psychological knowledge and recommender technologies are exemplified. The paper concludes with a discussion and an outlook on future work.

2 Theoretical Background

In the history of online sales many examples of online platforms exist which were characterized by high technical quality and innovativeness but lost market share or even disappeared because they did not appropriately consider user needs. For example, the first company offering books online was superseded by competitors who provided better user experience. Another example showing the importance of considering user needs is Boo.com, which was based on cutting edge technology but showed bad usability, see, for example, [5]. Recommender systems can be considered as state of the art technologies supporting online interaction and purchase and have demonstrated their benefits and capabilities in numerous studies. However, as [7] pointed out, decision support tools such as recommender systems consist of three parts: *"...database management capabilities, modelling functions, and a powerful yet simple user interface.."*. Specifically the latter offers high potentials for enhancement, by considering human capabilities such as attitudes, emotions, and other factors influencing their behaviour in their design. The goal to achieve is an enhanced quality of interaction between the human user and the computerized part of a system resulting in a better outcome for both, the user and the provider.

Recommender systems can be seen as the technical counterpart of real shopping environments. For about a century research in consumer psychology has been influential in advertising, marketing, and sales. Speaking of the *offline world* it does not surprise any more that the design of supermarkets in regard to shopping paths, lighting conditions or sound exposure is not left to chance and consumer psychology is omnipresent [8]. In comparison, psychological knowledge applied in the online sector is limited, although an increased consideration could be beneficial on different levels [9]. Specifically phenomena addressed in consumer and decision psychology are of interest in this regard [10, 11]. The challenge addressed in this paper is to take this knowledge to optimize recommender operated platforms in a way that consumers can, on the one hand, benefit from the advantages of information and communication technologies (ICT). This is possible because recommender systems are able to dynamically adapt to the individual user. This can constitute a meaningful alternative to offline purchase situations where an average sales assistant can be assumed to base his recommendations only on a limited set of alternatives. On the other hand it is important to make the user forget about the disadvantages online systems could have compared

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to real shopping experiences. These are, for example, the possibility to touch and investigate a product physically and to communicate with a human counterpart, negotiate a price or ask questions. The challenge for the service-provider is the increased difficulty to convince an online user about the benefits of a product or even persuade him or her to buy it, because there are limited possibilities to establish a pleasant atmosphere. In the following a spotlight is put on a selection of psychological concepts and theories which have a direct relation to buying behaviour and therefore build a promising basis for further research and to enhance recommender systems in a way that they are capable of supporting all facets and phases of human consumer behaviour. This is neither easy nor possible in just one iteration.

3 Basic Psychological Theories

The following list of theories is not intended to be exhaustive, it should just point out the potentials of psychological concepts which have, as demonstrated in numerous studies, a direct relation to human behaviour and insofar could also be useful for the enhancement of online behaviour in general and in regard to financial services in particular. Some of the elements of the theories have been either analysed for applicability or actually used within own studies [12, 13, 1], others are planned to be integrated in our future work.

- **Prospect Theory, PT**
PT is of interest in regard to the behaviour of consumers in situations characterized by uncertainty and risk. These are, when considering the work of [10] demonstrating that the assumptions of economic theory do not hold, almost all situations. Because of limitations in human information processing, systematic biases in rating situations and decision making are observable. For example, humans act risk seeking when a loss is probable, or risk averse when a profit can be expected [11, 14]. This asymmetry is, for example, one explanation why people invest additional money into loss-making investments.
- **Locus of Control Theory, LoC**
LoC implies that behaviour depends on the interpretation of a person whether she has control over a situation or interaction and the outcome of an interaction (internal locus of control). When a situation or outcome is beyond influence (e.g. the user has the feeling that the system or external forces have the control), then external locus of control is the case [15].
- **Attribution Theories, AT**
Attribution theories are, as LoC, assuming internal/external control as one important dimension, but also include other dimensions, for example stability vs. flexibility. It is not only of relevance whether control is perceived as internal or external but also if it is stable, depending on the domain or a particular situation [16, 17]. An example for the influence of LoC and AT in the context of financial services is that a person may assume that it makes sense to actively control her financial portfolio (internal control) to increase prosperity. A person who observes herself as externally controlled may think that anyway only governments with taxation policies and financial service providers are responsible for the financial status of the individual. This attitude can be stable or flexible, the latter, for example, by observing the own financial situation as depending on the global economy and the possibility to change when the financial crisis is overcome.
- **Expectancy-Value Theories, EVT**
This group of theories is based on the two dimensions expectancy

and value. Expectancy refers to the degree to which a person is capable of reaching a goal. Value refers to the importance the goal has for the person. Example theories of this group are the theory of planned behaviour (TPB) or the theory of reasoned action (TRA) and they are important in the context of online buying. Besides personal aspects (i.e., attitude to a behaviour), social aspects play an important role and influence the value. For example, how people from relevant groups such as peer groups, family and friend would judge a certain behaviour (e.g., the purchase of a certain product) [18, 19].

- **Need for Cognition / Elaboration Likelihood Model, NfC**
NfC implies that depending on the importance of the domain ("personal involvement") a person tends to process information on different elaboration *routes*. In domains which are of high importance for the person information is processed on the central route, characterized by a high level of elaboration (extensive collection of information, comparison, outweighing of pros and cons, etc.) The alternative way of processing, the peripheral route, is characterized by low involvement of the person and, as an effect, an intentional low investment of efforts in processing information. The type of elaboration is, for example, of interest when an online platform is intending to include persuasive technologies [20, 21].
- **Cognitive Dissonance, CD**
CD is assuming a mental model that a person establishes about a certain area of life, a behaviour or other relevant issues. The model only includes "consonant" information, which means that information present in the model should not be contradictory. For example, if a person thinks about financing a holiday trip with a loan this may contradict with a negative attitude towards taking out a loan for things that do not have a material value (such as cars or real estates). In this case dissonance occurs and, according to the model, mental efforts are invested to restore consistency [22]. For the concrete example an argument could be that the exchange rate of country's currency where the journey is heading is favourable and insofar money is saved.
- **Reactance Theory, RT**
Implies that humans are driven by the assumption that they can behave and act unrestrictedly. If a behaviour or an "object of desire" is not available or difficult to reach, its subjective value is increased and the reactant user tries to overcome this shortage by increased efforts [23]. Online platforms try to induce reactance by indicating limitations in product or service availability. In regard to financial services, for example, special offers for loans or financing models are made available for limited time periods.
- **Flow, F**
The central concept of the theory is the state of *flow* which is characterized by an immersion of the user with the system. Flow is, for example, observable on computer game players, musicians or craftsmen who smoothly interact with their tools without observable disruptions [24]. A platform offering financial services should aim at supporting flow by enabling a smooth interaction dialogue between user and system and giving the possibility to "play" with alternatives.

How elements of the enumerated theories and concepts could affect the interaction with a financial services platform is illustrated in the following example.

Example. Imagine a potential consumer is using an online system to inform herself about loan opportunities. Based on her attributional patterns (AT, LoC) she has a certain understanding of whether she is able to use an online platform and can control the outcome of

the product search. We assume that she is self-confident in the usage of the system (EVT, expectancy) and the system is appropriately designed that she can "play around" and easily evaluate alternatives (and eventually reaches a kind of "flow", F). Depending on the personal importance (EVT, value) of the product she is searching for (loan for a holiday trip, a car or a house) she will put low or high efforts in the evaluation, comparison, and selection of the product (NfC). When she knows what she wants and has good experiences with a certain brand or provider (PT, CD) she will not care that much what others say about her decision (EVT, peers). If she is uncertain, doesn't want to make a mistake or wants a product with a high status she will orient herself on information of other users (EVT, peers) and in what percentage they purchased what product (for example based on online ratings or discussions with her peer groups). If the product or service she has finally chosen is not available immediately, she will try to solve the problem by finding other sources from where to get the product (PT, RT) or she will resign and decide not to buy any product (AT).

4 Decisions as the Connecting Element

The direct application of the theories and concepts enumerated above is difficult because many of them are too abstract. It is therefore necessary to investigate the "atomic" element of consumer behaviour which is *decision*. Each purchase or even browsing for information to prepare a purchase is characterized by a singular decision or a sequence of decisions. They are made on the basis of gathered information, the consultation of different information sources, the outweighing of alternatives, etc. Economic theory has assumed that humans can be considered as *omniscient* and make decisions on the basis of *optimal rationality*. Since the work of Simon [10] it is commonly agreed that this assumption does not hold for most decision situations. The majority of human decision processes is characterized by limited information use, biased mental models and routines either because of missing capabilities or a low level of motivation to invest cognitive efforts. Depending on the kind of limitation, technological means supporting the basic decision processes have to be designed in different ways.

Felser [25], based on the work of [26], categorizes decisions in consumer behaviour into 4 types, namely *extensive*, *limited*, *habitual* and *impulsive* decisions. What type of decision is actually applied is depending on the type of product or service, the degree of personal involvement, and emotional contribution (activation) to the domain and other personality traits. For example, searching for an appropriate loan for an apartment can have very different characteristics and motives.

Extensive Decision. If a person is planning to buy the apartment this is a long term investment that influences the financial life of the person for decades. Therefore the person is probably highly involved, activated, and will invest high efforts to find out the best financing alternative and therefore applies an *extensive* decision procedure until he gets the best financial plan which the smallest influence in the current financial situation. The strategy followed has characteristics of the central route processing of need for cognition theory [20, 21]. Although this type of decision making is highly sophisticated, it has some weaknesses. For example, the amount of information considered in the decision is not directly proportional to the amount of information available, which means that even if higher amounts of information would be available, people prefer short cuts [25]. An empirical proof for this hypothesis could be shown in our own work [1]. Another insight is that higher effort invested into a decision does not

mean that the outcome of the decision is better. One of the reasons is that the dimensions consulted for a decision are often unconscious. An a posteriori justification is done on dimensions which can be rationalized but those may not be the ones which were responsible for the decision.

Limited Decision. Another person having in mind to rent an apartment and just needs money for new furniture may be less passionate and would apply other criteria to the decision process. She applies the second type of decision, which is limited decision. Decisions following this strategy are based on experiences (positive and negative ones) and heuristics which were derived from these experiences, such as "Brand A is better than brand B" or, "The more expensive, the better a product". The person may choose the company for financing furniture based on an advertisement she recently saw. In this case the availability heuristic, described by [11, 14], is applied (e.g., brands and companies that are commonly known are better). Following this heuristic could lead to choosing a financing the furniture shop offers to his customers (an alternative the first person probably would not think about). An influence could also have the social environment (subjective norm, [18, 19]). Recommendations of relatives or friends which have good experiences with a bank can be taken into account.

Habitual Decision. The third type of decision, habitual decision, can be seen as a combination of extensive and limited decision. Based on previous experiences a mental model has been established, on the basis of which consumer behaviour follows a routine sequence and may not involve explicit decisions. This strategy mainly is applied in routine behaviour when no extraordinary investment is planned (such as in the previous examples). For example, if a person has to transfer money to a country where the receiver still requires conventional paper based transfer, she typically goes to her familiar bank branch and transfers the money there although there might be another company who offers cheaper transfers to the target country. In the past the selection of the best bank might have involved extensive decision strategies. When these efforts were successful and resulted in selecting an appropriate bank, a mental model is build which drives future behaviour. If the combination of services, price and reputation has been working satisfactorily in the past it would not have a serious impact, if it did not work any more (e.g., prices for services are slightly increased) - in terms of financial loss or well-being.

Impulsive Decisions. The last form - impulsive buying - is characterized as a "reaction" to environmental stimuli rather active behaviour and may not include decisions at all. This form of occurs in the context of financial services, for example, when a credit card is used for buying things. This also involves investing money, but the investment is hidden and partly unconscious.

The previous paragraph was describing decisions on a general level. Beckett et al.[27] have focused their work on financial products and present their findings in the form of a four-field decision matrix which has parallels to the four types of decisions described by [25]. Additionally to involvement, which is part of the systematic of [26, 25] and NfC [21], the authors point out confidence as another relevant dimension, which is a relevant dimension in LoC and AT [17] as well as the EVT [18]. The first decision type included in the matrix is *repeat-passive* decisions - which correspond to habitual decision in the nomenclature of [25]. Based on positive experiences the consumer has developed *loyalty* to an enterprise (a bank or insurance) and does not explicitly search for alternatives. The *rational-active* decision type corresponds to the extensive decision strategy. The third type identified by [27], *relational-dependent* decisions corresponds to [25, 26]'s limited decision type and is based on heuristics regarding experience and brand. If this strategy has been successful, *trust*

is developed which reduces search and information processing activities. Finally, the impulsive type of [25] does not occur very often in the context of financial decisions. Therefore the matrix of [27] includes a fourth field labelled "no purchase". Figure 1 is showing the decision types of [25] and their counterparts described in the work of [27].

Habitual Repeat-Passive	Extensive Rational-Active
Impulsive No Purchase	Limited Relational-Dependent

Figure 1. Comparison of decision types of [25] and [27]

The matrix has been evaluated in a series of focus groups and three product types are corresponding to the different decision types shown in Figure 1: *basic transaction services* (existing accounts), *basic insurances products* (car, house), and *investment services* (stocks, shares, pensions, etc.). Repeat-passive decisions mainly take place in the context of basic transaction services, when brand loyalty to banking institution and confidence in the decision is high. Rational-active decisions are made when price is one of the most important criteria. This strategy is characterized by the necessity to search for products, to deal with a big amount of information and to thoroughly analyse the outcome. This could be necessary because, for example, insurance companies offer more or less the same services and products and deliberately make comparison to competitive products difficult. Relational-dependent decisions are, according to the results achieved by [27] still strongly depending on personal communication and advice, because of the inherent complexity of the products and services.

The previous paragraphs were devoted to the *content* of decision processes involved in consumer behaviour. The second, similarly important dimension in regard to online platforms based on recommender systems is the *presentation* of information. We take the differentiation of [9] who proposes to differentiate two roles an online consumer has to assume, one as a *shopper* and the second as a *computer user*. What characterizes and drives the shopper has been emphasized above, in the next part the focus is put on the role of a computer user. Supporting a user in decision making requires the provision of interfaces that is appropriate, an issue the research areas of human computer interaction (HCI), usability engineering and user experience [28, 29, 30, 31] are dealing with. In regard to online consumer behaviour one of the major goals has to be to design interfaces in a way that they compensate the limitations an online system has in comparison to a real world shopping situation and emphasize the advantages online systems have over real world shopping. The flexibility, adaptiveness, and adaptability of recommender systems enabling an individual support of each consumer is probably not available in typical shopping environments and insofar bear high potentials but are also challenging in regard to user interface design. This means, for example, that the development has to be based on state of the art interface design technologies, such as responsive design [32]

and mobile first [33]. Not only the technology in the back-end (the recommender system) has to be adaptive, but also the interface itself should adapt to the needs of users. Burke [34] proposes a hybrid solution for recommender system technology, a similar approach could also be imagined for the user interface part. A one fits all approach seems not to be contemporary, different interface alternatives seem to be a proper way to provide an adaptive access to a recommender system for different groups of users in different contexts of use. One and the same user could be interacting with different views of the system, on different devices, depending on the task at hand, contextual aspects, and psychological factors such as involvement in the domain. This means that interfaces do not only have to be adaptive, but personalized, platform independent and customizable [35, 36]. The application of conventional usability engineering methods to accompany the development is crucial [37, 38], integrated in a user centred design process and combined with frequent evaluations involving representatives of the intended user groups.

5 An Integrated Model as Basis of Research

The aspects addressed in the previous sections characterizing consumer behaviour in general and online consumer behaviour in particular are difficult to capture. Their comprehension would be easier if a way could be found to operationalize them based on an integrated framework. The technology acceptance model (TAM) originally proposed by Davis [39] could build a basis for this attempt. TAM and its derivatives have been empirically validated in numerous studies, and it optimally combines the two dimensions emphasized in the previous section. Content - meaning the psychological aspects related to a decision making and Presentation - aspects that related to human computer interaction. The TAM has relations to many of the theories and concepts enumerated in the previous sections. Figure 2 shows an adapted version of the latest version of TAM, TAM 3, introduced by [6]. The dimensions of TAM and their relation to the concepts and theories enumerated above are described in this section. The descriptions are partly taken from [6, 40].

- **Experience**
Already having used a system or similar ones can have an influence on many factors, such as the perceived usefulness and the subjective norm. In relation to psychological theories, experience can increase, for example, the confidence and the assumption of internal control (LoC, AT).
- **Voluntariness**
The extent to which users perceive the usage of a system to be non-mandatory. This aspect relates to reactance theory (RT) - if a person has the freedom to choose an online system for financial services additionally to offline services this makes a difference to being forced to use online services (because the nearby bank branch has been closed).
- **Subjective Norm**
A person's perception that most people who are important think he or she should or should not perform a behaviour or use a system. There could, for example, be a conflict between the personal preferences and the attitude of the relevant others, which could lead to cognitive dissonance (CD) ("I would issue a credit for a holiday trip".)
- **Image**
The degree to which the use of an innovation is perceived to enhance one's status in the social system. In regard to the provision of different platforms (desktop or mobile platforms) this aspect,

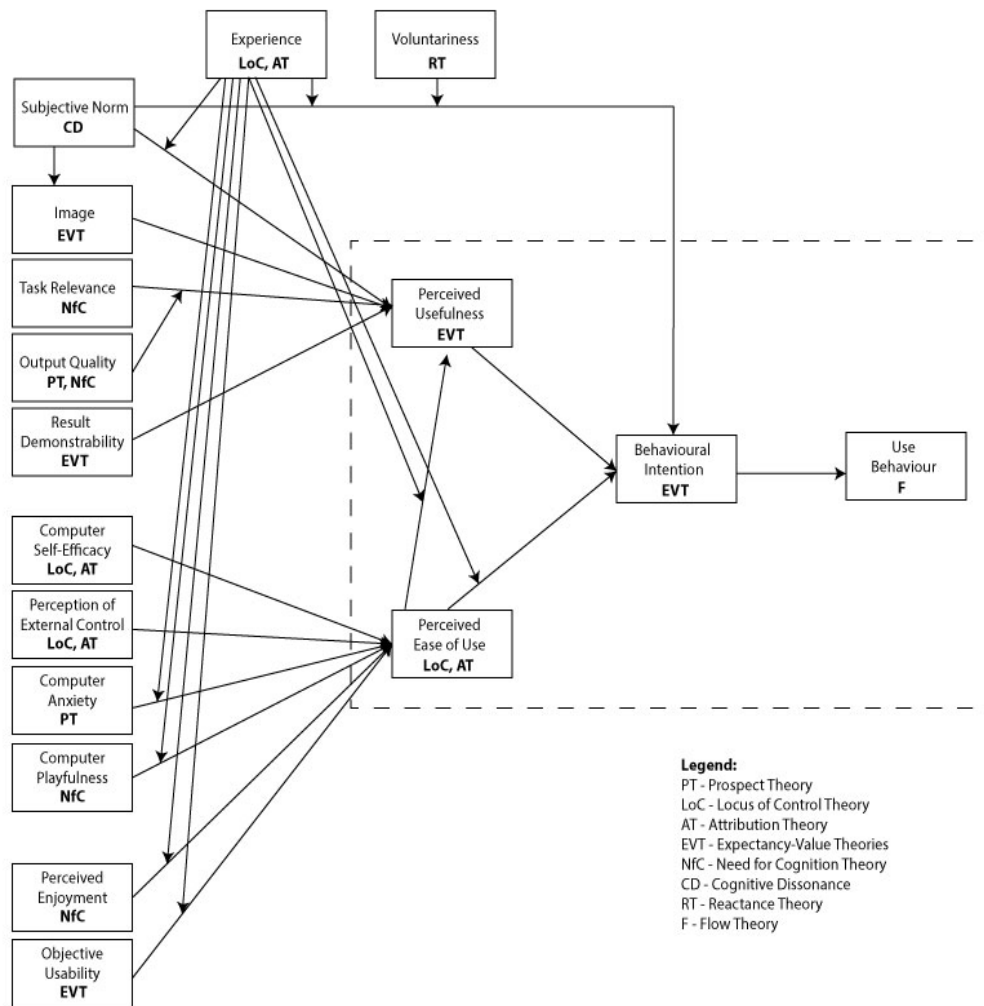


Figure 2. Technology Acceptance Model Version 3, adapted from [40] and complemented with example relations to psychological theories

for example, influences the usage of a mobile app. It is depending on whether or not the platform is accepted by the peer group (Apple, Android, Windows mobile) and illustrates that the attitude towards a system is not always based on functional requirements (EVT).

- **Task Relevance**

A person's perception regarding the degree to which the target system is relevant to his or her life. If a system offers enhanced efficiency (e.g., not having to visit a bank branch for basic tasks) without losing quality (NfC) it will be used.

- **Output Quality**

The degree to which a person believes that the system offers the same services and enables to achieve the same results as other alternatives, for example, services offered in a bank branch (PT, NFC).

- **Result Demonstrability**

Tangibility of the results of using the system. This aspect has relations to subjective norm and image, for example showing increased prosperity as a result of intelligent investments (EVT).

- **Computer Self-Efficacy**

The degree to which a person believes that he or she has the ability to perform the intended task. This depends on the experience with computer systems in general, and on the experiences within a specific domain (e.g. financial services) in particular (LoC, AT).

- **Perceptions of External Control**

The degree to which a person believes that an organizational and technical infrastructure exists to support use of the system. This could also be influential in a negative way (according to LoC and AT) when a person feels that the organization behind a system limits his or her performance or degrees of freedom.

- **Computer Anxiety**

The degree of a person's fear, when she/he is faced with the need of using computers to access services. Specifically in the context of financial services (or even online transactions with credit cards) people are anxious because of the danger to lose money (PT).

- **Computer Playfulness**

The degree of cognitive spontaneity in computer interactions. If a system supports this kind of interaction, such as simulating differ-

ent variants of financing, this supports persons engaging in extensive decision making processes (NfC).

- **Perceived Joyment**

The extent to which using a specific system is perceived to be enjoyable, whereas enjoyment can have different dimensions. Feeling safe in the sense of nothing unexpected can happen when transferring money could be one form of enjoyment. Another one is developing trust towards an institution or a platform when the latter is characterized by transparency and comprehensibility (NfC).

- **Objective Usability**

A comparison of systems based on the actual level of effort required to complete specific tasks. If it is faster to go to the bank branch to transfer money than using the computer interface, then the objective usability of an online system would be low (EVT).

- **Perceived Usefulness**

The degree to which a person believes that using the system will help him or her to attain gains in life quality. Saving money by using an online system instead of personal services convinces people to adapt to new technologies (EVT).

- **Perceived Ease of Use**

The degree of ease associated with the use of the system. Besides the utility aspects of a system, the subjective usability is relevant. If people do not trust a system or are doubtful in their usage, they would not use it (LoC, AT).

- **Behavioural Intention**

The degree to which a person has conscious plans to perform or not perform some specified behaviour. Only if the enumerated dimensions are fulfilled in a certain degree, a person will have the intention to use a system. The correlation between the intention and the actual use still is low (EVT).

- **Use Behaviour** When every aspect is, depending on the individual preferences, optimally fulfilled, then a flow experience could occur (F).

As emphasized in the enumeration of elements, the TAM has connections to the concepts and theories addressed in this paper [9] and would also allow the integration of additional aspects, for example trust, cf. e.g. [41, 42, 43, 44]. The TAM has also served as basis for research in the financial services domain, cf. e.g. [45, 46, 47].

6 Empirical Work

The theoretical concepts presented in this paper have been evaluated in several empirical works. In this section a selection of these works and their relation to the theoretical parts of the paper is presented and relations to the enumerated models and concepts are emphasized.

The first work in this regard is a paper on serial position effects. The effect, being one of the oldest phenomena in psychological basic research [48, 49, 50], is characterized by the fact that items presented in a list or sequence are better memorized when presented at the beginning or the end of the list. In our work [1] we could show that changing the sequence of items significantly influences the recall of the items and this offers a possibility to influence the interaction between a consumer and a computer system on the level of presentation. Depending on the motives and needs that drive the consumer (e.g. involvement, confidence, type of decision, willingness to invest efforts) important information can be put in the sequence where it has the highest probability to be perceived and memorized for further usage. Figure 3 shows the effect on the recall of items by simply changing their order. The list used in the study contained features of

digital cameras (pixels, storage, zoom). Only the order of items was manipulated but this significantly increased their recall.

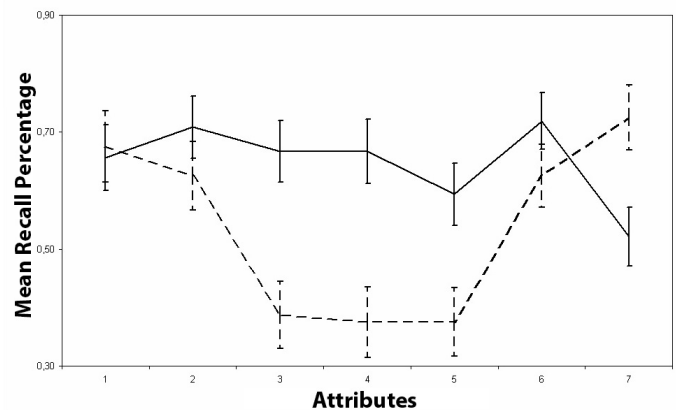


Figure 3. Recall frequency in a manipulated item sequence (continuous line) and a familiar item sequence (dashed line) [1]

A more recent work which builds upon the work on serial position effects was carried out in the domain of group decision making [52]. Making decisions in groups, for example choosing a dinner with a business partner or deciding what movie to watch with friends in a cinema always involves psychological phenomena on the individual as well as on the group level. Decisions derived in group situations are influenced by rhetoric skills of the participants, negotiation techniques applied, leadership competency and other personality factors. In contrast to this real-time and synchronous approach, an online tool supports asynchronous and sequential decision procedures. Psychological concepts that could have an impact in this kind of decision process are, for example, originating from research groups who developed the prospect theory [11, 14]. One group of effects are *anchoring* or *framing* effects, or more general, *context* effects [53, 51]. A following small example illustrates their influence. To be able to sketch a financial plan it is necessary to have a starting point, the anchor stimulus. This starting point is typically the amount of money that has to be financed. A strategy that is frequently used in advertising is not to use the whole amount for evaluation (for example, 100.000 are needed + overhead costs) but the monthly rate (for example 500). Within the study we investigated alternatives of presenting information and were interested in the possibilities of manipulating serial position effects and other form of presentation, concretely based on the multi attribute utility model (MAUT). The results showed that MAUT concepts can counteract serial position effects and insofar represent an appropriate means to steer decision processes. Figure 4 is showing an example screen of the CHOICLA group decision support tool on which preferences can be declared based on multiple attributes.

The last empirical work presented was focused on persuasion [54] and the potentials of the asymmetric dominance effect, better known as *decoy* effect [55]. This concept has also a relation to anchoring and framing effects which can be manipulated. In contrast to the example above where information is hidden or presented in another form, the decoy effect uses the influence of adding additional information to a decision situation. Adding a decoy element is intended to divert or even disturb the attentive processes of a potential consumer and open a new perspective to him or her to lead a decision in a certain



Figure 4. Choicla Screen to enter preferences for restaurants based on MAUT [52]

direction, to persuade a user to purchase a product or to initiate a preference construction which would not have been started without the distractive element. In our paper we investigated the asymmetric dominance effect and could show possibilities how to integrate them into recommender systems. Figure 5 is showing a decoy situation. Before introducing the decoy element (D) two products are available to the customer, C (competitor product) and T (target product). C is characterized by a lower price, but also by lower quality than T. As price is one of the most important dimensions in purchase decisions [26] consumers tend to buy C. With introducing the decoy D which has a lower quality than T, but a higher price, the focus of attention is directed to quality. This new perspective is not only of advantage for the provider (because of higher revenue) but also for the consumer (because of higher quality and satisfaction with the product).

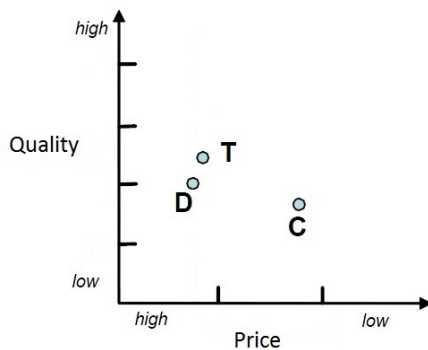


Figure 5. Showing the example for the asymmetric dominance (“decoy”) effect. Product C (competitor) is of lower quality than product T (the target product), but C is cheaper and price is typically the feature with the highest influence in purchase situations. People would therefore, in general, choose product C. By introducing a product D (decoy) which is of higher quality than C, but of lower quality than T and more expensive than both of them, the viewpoint (anchor, reference frame) changes, and product T is preferred by the majority of consumers [54]

7 Discussion and Conclusions

In this paper we have tried to emphasise the potentials of psychological theories to enhance the quality of interaction between users and

computerised systems based on recommender technology. The theoretical basis builds a selection of psychological concepts and theories which have been empirically investigated in numerous studies and proved themselves as being relevant in the context of consumer behaviour. An increased consideration of knowledge from psychology could enhance the quality of recommender systems, specifically on the level of the user interface. The different types of decisions related to consumer behaviour were discussed and possibilities of recommender systems to support such decisions were exemplified. The technology acceptance model serves as a basis for further research in this area because it already integrates many of the relevant psychological concepts and theories that have been demonstrated to be influential in the context of consumer behaviour. With an appropriate consideration of this knowledge, recommender systems could overcome the disadvantages online systems have in comparison to offline interaction between consumers and, for example, shop assistants. The advantages of recommender systems such as their capabilities of processing huge amounts of data, selecting the correct products from millions of alternatives, and calculating the best product for a consumer within a few seconds could be exploited in a better way if not only the back-end functionalities but also the front-end, the interface to the customer is enhanced in an appropriate way.

Although our work is addressing different domains, the conceptual work sketched and the empirical studies performed are also applicable to the financial sector. Specifically of interest in this regard are the different types of decisions driving potential customers and motivating them to use an online system, choosing a product or service, changing parts of his or her financial portfolio. In the context of recent developments in the financial sector (e.g., merging of banks and insurance companies, closing of branches) the importance of online services will increase. Appropriate systems supporting the different needs, motives of end consumers, and also respecting the different levels of efforts people are willing to invest into financial decisions will be more important than ever before. Recommender systems integrating psychological aspect and simulating a “human image” [36] could fill the arising gaps. With the system MYLIFE, an award winning platform, we could demonstrate respective possibilities. MYLIFE is an online platform enabling insurance agents together with end consumers to manage the consumer’s financial portfolio in a cooperative partnership instead of putting the consumer in the role of a “suppliant” towards financial service providers. The system consists of an intelligent algorithmic basis FASTDIAG [56] and an appropriate user interface visualizing in an integrated fashion the finance portfolio of a customer.

The empirical work presented can only be seen as the starting point in the endeavour of enhancing human recommender interaction in the emphasized way. An unresolved problem in this regard is, for example, how a recommender system could find out what strategy a consumer is currently applying (e.g. extensive or limited decision) and to change the presentation of information accordingly. There are of course domains where one strategy is the most probable one (e.g. financing a real estate are probably based on extensive and central route elaboration) but further research is necessary to address this problem. Of course transferring services from offline to online does not only have advantages. In the context of current developments in regard to privacy and business ethics this opens new challenges which are influencing the orientation of future research activities. Our major goal is to complete the “puzzle” of which we have already identified elements in our past research work.

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