Chapter 8
Biases in Group Decisions

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Abstract Decision biases can be interpreted as tendencies to think and act in specific ways that result in a systematic deviation of potentially rational and high-quality decisions. In this chapter, we provide an overview of *example decision biases* and show possibilities to counteract these. The overview includes (1) biases that exist in both single user and group decision making (decoy effects, serial position effects, framing, and anchoring) and (2) biases that especially occur in the context of group decision making (GroupThink, polarization, and emotional contagion).

8.1 Introduction

Research suggests that groups have the potential to outperform individuals in terms of decision quality [39, 47]. The collective memory of a group in many cases entails more *decision-relevant knowledge* than the memory of each individual group member. The same holds for *solution knowledge*: different group members are able to recall approaches to solve problems or take decisions from the past. However, groups often fail to achieve this goal [16]. One reason for explanation of this phenomenon is *decision biases*, which are defined as a *tendency to think and act in specific ways which results in deviations from rational and high-quality decisions* [3, 25, 37, 39]. Decision biases occur in single-person decisions as well as in group decisions. In this chapter, we summarize existing research related to decision biases in recommender systems (see, e.g., [22, 28]) and point out issues to be dealt with especially in the context of group decision making. For each of the mentioned biases, we first explain the basic underlying principle, provide examples, and then focus on specific aspects that have to be taken into account in group decision

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scenarios. The inclusion of theories of human decision making into recommender applications is still a relatively young research field with a couple of open research issues [22].[1] The biases discussed in this chapter represent examples but in no way cover the complete set of biases investigated in psychological research [3, 25].

8.2 Decoy Effects

Within an item list, *decoy items* are alternatives inferior to all other items. Decoy items trigger a violation of the *regularity choice behavior* axiom which says: the inclusion of a completely inferior option can *not* change the probability that an existing option will be chosen [20, 27]. Superiority or inferiority of items is often measured by comparing item properties with regard to the distance to the corresponding optimal value. Although not attractive for the user, a decoy item can manipulate his/her selection behavior. If we assume that T is an item that should be pushed in terms of purchasing probability and C is a competitor item, the inclusion of a decoy item D can trigger the following situation: $P(T,\{T,C,D\}) > P(T,\{T,C\})$ where P(X,I) denotes the purchase probability of X given the *item set I*. Consequently, the regularity choice behavior axiom gets violated.

An example of a decoy effect is provided in Table 8.1: item D represents the *decoy item*, T represents a *target item* (item that should be pushed to increase purchase), and C represents a *competitor item*. In this case, users perceive an increased attractiveness of robot T due to the fact that it has a reliability that is similar to the optimum one provided by robot D. However, robot T has a significantly lower price which makes this option a compromise between optimal reliability and corresponding costs. This kind of effect is denoted as *compromise effect*. Further related effects are *asymmetric dominance* (the decoy item is outperformed by the target item in all dimensions) and *attraction effect* (the target item is only a little bit more expensive but completely outperforms the decoy item with regard to reliability). An overview of decoy effects, their role in recommendation scenarios, and how to counteract them is provided in [13, 28, 48, 49].

Felfernig et al. [15] show the existence of compromise effects in the financial service domain. Within the scope of a study that operated on a real-world financial service dataset, participants had to select items they would prefer to purchase given a

Table 8.1 Example of a *compromise effect*: item (robot) T is interpreted as a compromise since it has nearly the same reliability as D but a significantly lower price

Item (robot)	T	C	D
Price	3.000	1.500	5.000
Reliability	9	4.5	10

[1] See the ACM RecSys Workshop Series on *Human Decision Making and Recommender Systems*.

specific set of financial services. The reference set without decoy items consisted of *bonds*, *gold*, and *funds* whereas a decoy set consisted, for example, of *bonds*, *gold*, *funds*, and *shares*. In this setting, *shares* (the decoy item) make *funds* (the target item) a compromise alternative and thus help to increase the selection probability of *funds* (under the assumption that *shares* have a significantly higher risk compared to *funds* and often similar return rates). Note that decoy items do not only play a role when the goal is to push certain items from a list [28]. Decoy items can also help to reduce the *time needed to make a decision*, since they provide a good basis for resolving cognitive dilemmas, and they help to *increase the confidence in a decision* by providing an easy means to explain it [28].

An analysis of the existence of decoy effects in the context of *group decision making* is presented in [44]. The authors analyze the existence of decoy effects in employee selection among job applicants on the shortlist. The attributes used as a basis for comparison are *work sample score* and *promotability score*. The relevance of this analysis is even increased by the fact that only 26% of high-level employee selection decisions are made by a single person [43]. For decision scenarios with a low degree of interaction between different group members it seems to be clear that decoy effects already occur on the individual level and then are propagated to the group decision level. However, in the study of [44], study participants were sitting at the same table discussing alternative job applicants. The decoy effect was even increased in situations where study participants also had the defined role of being responsible for the chosen candidate (aspect of accountability). An explanation of this effect is that study participants had to think about *arguments and explanations* as to why they made a specific decision (proposal to choose a specific job candidate) more intensively. Decoy elements provide a basis for the construction of such explanations [28].

8.3 Serial Position Effects

Serial position effects (primacy/recency effects) can occur in different forms. First, if a recommendation list is presented to a user, items at the beginning and the end of this list are investigated more intensively—a related study is presented in Murphy et al. [36] where users were confronted with a list of weblinks. Second, serial position effects have a *cognitive dimension* in terms of the probability of being able to memorize items included in a list [38].

The impact of serial position effects on user selection behavior has been investigated in recommendation settings addressing single users (see Fig. 8.1): Felfernig et al. [12] report that item attributes shown to a user in a sequence have a higher probability of being recalled if they are mentioned at the beginning or the end of the sequence. This holds true for popular/well-known properties, and also for those that are less popular/less well-known. The item attributes recalled by a user also have an impact on his/her selection behavior, i.e., item attributes presented at the beginning and the end of a dialog are used as selection criteria with

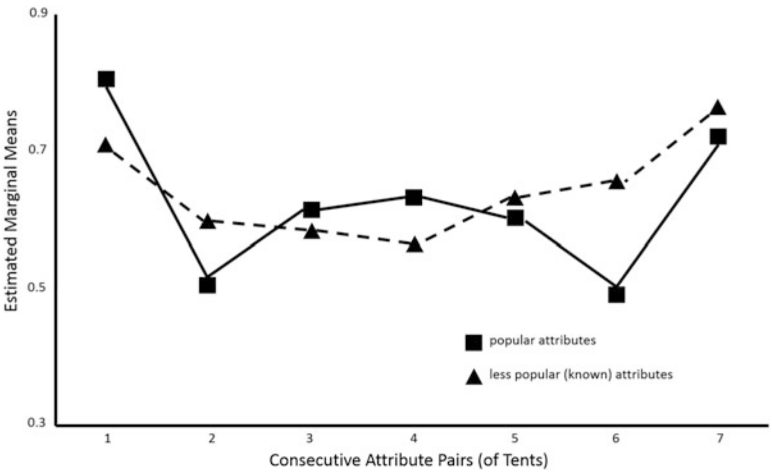

Fig. 8.1 Serial position effects when item attributes are presented in a sequence [12]. Item attributes presented at the beginning and the end of a list are recalled more often than those in the middle. This holds in situations where popular attributes are positioned at the beginning and the end of a list (solid line) but also in situations where less known/popular attributes were mentioned at the beginning and at the end of the list (dashed line)

a higher probability. A similar effect can be observed when analyzing argumentation sequences related to items: if positive arguments are positioned at the beginning and the end of an item evaluation, the evaluation of the item tends to be better [46].

The order of items in a list has also an impact on decision making in the context of *group decision scenarios*. Highhouse and Gallo [19] show that the order in which candidates are interviewed has an influence on which candidates are finally chosen. Specifically, recency effects were observed, i.e., job candidates interviewed at the end of the selection process had a higher probability of being selected. Stettinger et al. [46] present the CHOICLA group decision support environment that is based on social choice-based preference aggregation mechanisms for groups [29]. The environment supports different types of preference definition mechanisms which range *from* a star-based rating that can be used for simple items such as movies *to* items that can be evaluated using interest dimensions on the basis of multi-attribute utility theory (MAUT) [50]. The role of serial position effects in CHOICLA-based group decisions is discussed in [46] where the impact of the ordering of positive and negative arguments regarding an item is evaluated. Study participants were organized into groups of five to six persons who had to evaluate restaurants they would like to visit for a dinner. The *variation points* in the study were (1) the used *rating scales* (*5-star* vs. *MAUT* rating scale based on the interest dimensions *ambience*, *price*, *quality*, and *location* of the restaurant) and (2) *two different sequences of a set of arguments* in a restaurant review. In one review version, the positive arguments were positioned at the beginning and at the end of the evaluation (*positive salient* version), in the other version the negative arguments were positioned at the beginning and at the end (*negative salient* version). One major insight of the study was that MAUT-based preference elicitation can counteract decision biases since there were no significant differences in the evaluation of the items in the positive and negative salient version. In the case of star ratings, the overall item evaluation in the negative salient version was significantly lower than in the positive salient version.

8.4 Framing

The way in which an alternative is presented to the user can influence a user's decision making behavior [24]. According to *prospect theory* [24], decision alternatives are evaluated with regard to potential losses and gains, where the impact of losses is evaluated higher than the impact of gains (user-specific asymmetric evaluation function). An example of framing is *price framing* [7]: two companies (*x* and *y*) sell wood pellets. Company *x* describes its product as *pellets for €24.50 per 100 kg with a €2.50 discount if the customer pays with cash* whereas company *y* provides the description *€22.0 per 100 kg, and charges a €2.50 surcharge if the customer uses a credit card*. Company *x* rewards buyers with a discount which would trigger an increased purchasing of items *x*, even though both offers are equivalent from the cost perspective. Framing effects can be reduced, for example, if explanations are required for a final decision [33]. These effects occur more often when decision heuristics are used, compared to situations where persons follow an analytic processing style to make a decision [31]. Framing effects also exist in *group decision scenarios* [9, 32, 40]. In gain situations, there is a tendency of more risk-awareness whereas in loss situations there is an increased risk-seeking tendency [9].

8.5 Anchoring

Anchoring represents a tendency to rely too heavily on the first information (the anchor) received within the scope of a decision process. Anchoring effects trigger decisions, which are influenced by a group member who first articulated his/her preferences [21, 45]. Related results in decision support scenarios are confirmed by social-psychological studies which show the relationship between decision quality and the visibility of individual user preferences [34]. It was shown that hidden preferences in early decision phases of a group can increase the amount of decision-relevant information exchanged by group members, and that a higher degree of information exchange correlates with a higher quality of related decision outcomes. Thus, early preference visibility triggers a *confirmation bias* where a group searches for information that confirms the initial views of group members and a *shared information bias* which reflects the situation where a group focuses on discussing information available to all group members but not on figuring out and sharing new decision-relevant information. In group decision settings, there is also a tendency to not consider conflict-inducing information related to a preferred alternative if the group members providing this information are in the minority [26].

Anchoring effects have also been analyzed in the context of recommender systems. For example, in the context of collaborative filtering recommender systems, reference ratings of other users shown to the current user within the scope of an item evaluation (rating) process have an impact on the current user's ratings [1, 2, 10]. Manipulated higher average ratings shown to the current user trigger higher user ratings, manipulated lower ratings have the opposite effect. Furthermore, adapting the preference definition interface (e.g., from a 5-star rating scale to a binary one) can help to counteract such biases. For recommender user interfaces, this also means that item rating tasks should not include available rating information from other users [10].

Felfernig et al. [14] show the existence of anchoring effects in group-based software engineering scenarios. In this context, preference shifts were detected when software teams engaged in a university course on software requirements engineering had to make decisions regarding different *aspects of their software project* (e.g., *type of evaluation*, *presentation*, *programming language*, and *database technology*). Stettinger et al. [45] also analyze group decision scenarios in software engineering. In this context, they focus on requirements engineering where groups of software developers have to complete a *requirements prioritization task* in terms of deciding which requirements should be implemented in their software project. The existence of anchoring effects could be shown: the earlier the preferences of individual group members were shown to other users, the higher the probability of the occurrence of anchoring effects (see Fig. 8.2). The earlier user-individual preferences are disclosed, the lower the perceived quality of the decision outcome and of the perceived decision support.

Late preference disclosure increases discussion intensity and information exchange between group members, which has a positive impact on decision quality [8, 18]. Schulz-Hardt [42] point out that *overconfidence* within a group can be triggered by a shared information bias. Atas et al. [5] show the application of recommendation technologies in group decision scenarios to foster information exchange between group members. In the presented study, recommendations with different degrees of diversity were delivered to group members—the degree of information exchange between group members increased with an increased degree of recommendation diversity.

8.6 GroupThink

GroupThink [11, 23] occurs in situations where members of a cohesive group have a clear preference in terms of avoiding conflicts and maintaining unanimity, and are not primarily interested in analyzing existing decision alternatives [23]. In such situations, groups often fail to analyze relevant alternatives in detail, do

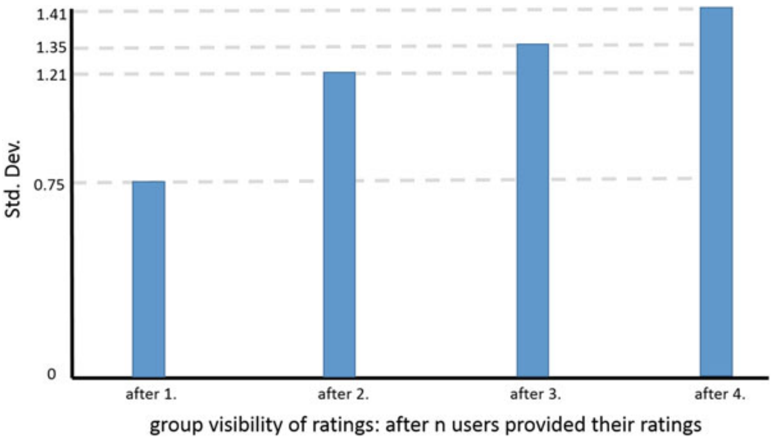

Fig. 8.2 Anchoring effect in requirements prioritization [45]. The earlier individual preferences are shown to other users (e.g., after 1 user has defined his/her preferences), the less ratings of users differ (measured in terms of standard deviation)

not adequately take risk into account, and do not focus on the exchange of additional decision-relevant information. GroupThink can be increased by encouraging conformity within a group [4] (when the majority of group members expresses an opinion different from an individual [30]), by an unwillingness to analyze existing alternatives, and by decision environments that do not tolerate *dissent*, a major ingredient and precondition for fostering information exchange between group members. Finally, GroupThink also increases the *confirmation effect*, i.e., the tendency to favor and recall information units in a way that confirms existing preferences [23, 39]. There are different ways to avoid GroupThink. Leaders should not articulate their opinion to other group members before discussing relevant alternatives in detail. Experts outside the group should be integrated in order to stimulate diverse opinions, related debates, and information exchange which are crucial for high-quality decision making. As already mentioned, an approach to exploit recommender systems functionality to stimulate information exchange in group decision processes is presented in [5].

8.7 Emotional Contagion

Emotional contagion describes the influence of the affective state of an individual on the affective state of other individuals within a group [6]. This effect can have a positive or a negative impact on overall satisfaction with a group decision [6]. The strength of the effect also depends on the item domain. For example, emotional contagion is more likely to happen in a music recommender system than in TV watching, since people are often more aware of others when not solely staring at a screen [30]. An approach to counteract this effect in group decision scenarios is not to allow information exchange between group members in the very early phase of a group decision process. On the level of recommendation algorithms, emotional contagion and different personality aspects can be used to improve, for example, the prediction quality of the group recommender [30, 41] (see also Chap. 9).

8.8 Polarization

There is often a tendency in groups to shift towards more extreme decisions compared to the original positions/preferences of the individual group members [9]. For example, in group-based investment decisions it can be the case that—although individual group members prefer an average risk investment strategy—the final chosen risk level is higher than the preferred risk levels of individual group members. This tendency to shift towards more extreme decisions in the context of group decision making is denoted as *group polarization* [35]. Group decisions can be more risky if the original opinions of individual group members tend to be risky (*risky shift*). Vice-versa, there also exists a *cautious shift* if group individuals are supporting more conservative alternatives [17]. In the context of group investment decisions, Cheng and Chiou [9] show that group decisions appear to be more cautious in gain situations and more risky in loss situations. A reduction of such a polarization effect can be achieved by including dissent, which also helps to trigger discussions more related to potential negative impacts of a decision. Recommender systems aware of polarization can adapt, for example, the utility estimates of recommendations and provide corresponding explanations. To the best of our knowledge, such concepts have not been integrated into recommender systems up to now.

8.9 Conclusions and Research Issues

Although groups have the potential to perform better than individuals in solving decision tasks, suboptimal decisions are made due to different types of biases (e.g., decoy effects, serial position effects, framing, anchoring, GroupThink, emotional contagion, and polarization). Without claiming to have provided a complete discussion of possible biases in group decision making, we have emphasized biases that have been analyzed in single-user recommendation contexts and, to a lesser extent, in the context of group decision making. There exist a couple of research contributions related to the analysis of decision biases, especially with regard to their impact on the development of recommender applications. A major focus of existing work in the field is to show the existence of such biases in different item domains and recommendation contexts. However, it is even more important to develop approaches that help *counteract* these effects on different levels, such as recommender algorithms and recommender user interfaces. Avoiding biases helps to increase decision quality; consequently, related research contributions have a potentially high impact on the quality of future group recommender systems [45].

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