Chapter 20
Source Factors in Recommender System Credibility Evaluation

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20.1 Introduction

Recommender systems are taking on an important role in supporting online users during complex decision-making processes by providing personalized advice [9, 73]. Yet, although recommender systems make recommendations based on often sophisticated data mining and analysis techniques, it cannot be automatically implied that the advice provided by a system will be accepted by its users. Whether a recommendation is seen as credible advice and actually taken into account not only depends on users' perceptions of the recommendation but also of the system as the advice-giver. The traditional persuasion literature suggests that people are more likely to accept recommendations from credible sources. It has recently been argued that creating a credible recommender system is important for increasing the likelihood of recommendation acceptance [32, 42, 69, 108, 162]. The question of how to actually translate credibility into system characteristics in the context of recommender systems remains, however, underexplored.

Recent research regarding the persuasiveness of technology suggests that technologies can be more credible and persuasive when leveraging social aspects that

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elicit social responses from their human users [42, 105]. This notion emphasizes the role of recommender systems as quasi-social actors, and thus, sources of advice whose characteristics influence the perceptions of their users. Various influential source factors have been investigated in the traditional persuasion literature based on human-human communication. Recent research in the context of human-computer interaction found that these factors are also important when humans interact with technologies [42, 43, 105, 124]. With regards to recommender systems, some studies exist that have investigated various influences of system characteristics when users evaluate systems as well as recommendations (e.g. [28, 91, 108, 121, 122]). While these findings provide good examples of source factors that help to develop more credible recommender systems, still many possibly influential source characteristics have not been examined. Consequently, this chapter seeks to provide a synopsis of credibility-related research to draw attention to source factors which likely play a role in recommender system credibility evaluations. For that purpose, this chapter will first give a brief overview of the source factors found influential in traditional interpersonal advice seeking relationships. Then, source characteristics which have been studied in the context of human and technology interaction and, in particular, in the recommender systems realm will be discussed. Finally, the chapter identifies research gaps in terms of source factors that have yet to be examined in the context of recommender systems. Overall, by exploring existing findings and identifying important knowledge gaps, this chapter seeks to provide insights for recommender system researchers as far as future research needs are concerned. It also aims at providing practical implications for recommender system designers who seek to enhance the credibility of the recommender systems they build. Note that this chapter focuses on the source characteristics of recommender systems that determine users' credibility perceptions. The issue of human users' decision-making and the role of recommender systems to support these processes is dealt with in Chap. 18. Furthermore, see Chap. 6 for discussions about contextual information in recommender systems.

20.2 Credibility Evaluation of Online Sources

With the plethora of information available online, a growing number of online users seeks an effective way to find information and evaluate its credibility. Past online credibility literature has identified a number of different ways that online information seekers use for their online credibility judgment. At the beginning of online credibility research, a number of research groups (e.g. [127, 142]) have identified five criteria that users should employ in their assessments of the credibility of online information: accuracy, authority, objectivity, currency, and coverage. Several subsequent empirical studies, however, have revealed that Internet users do not vigorously apply all five criteria in their judgment of online information credibility [39, 134]. Rather, recent studies found that most Internet users invoke cognitive heuristics and rely on others to evaluate the credibility of information

and sources online [92]. This means that simple cues displayed by online sources (e.g. Website design/presentation, positive reviews from consumers, endorsements from a third party) can be the primary factor in users' online information credibility assessments. Indeed, a common finding in online credibility research is that online users often process the surface characteristics of Websites and sources when evaluating credibility [40, 42]. In the recommender system context, this suggests the need for research that examines the impacts of source characteristics on system credibility evaluation.

20.3 Recommender Systems as Social Actors

Most existing recommender system studies have viewed recommender systems as software tools and have largely neglected their social role in the interaction with users. A growing number of studies, however, argues that computer applications like recommender systems need to be understood as "social actors" [124]. Nass and Moon [105] urged that people construct social relationships with machines including computers, and apply social rules in their interactions with technology. Indeed, several past empirical studies have shown that individuals form social relationships with technology and that these social relationships form the basis for interactions with the technology [44, 96, 103, 106, 115, 123]. A good number of recommender system studies also support this "Computers as Social Actors" paradigm. Wang and Benbasat [154], for instance, found that users perceived human characteristics such as benevolence and integrity from recommender systems and treated systems as social actors. Zanker and his colleagues [165] argued that interactions with recommender systems should not only be seen from a technical perspective but should also be examined from social and emotional perspectives. The findings by Aksoy et al. [2] suggest that the similarity rule is also applied when humans interact with recommender systems. They found that a user is more likely to use a recommender agent when it generates recommendations in a way similar to the user's decision-making process. Morkes et al. [98] demonstrated that computer agents that use humor are rated as more likable, competent, and cooperative. More recently, Yoo [161] investigated how virtual agents embedded in system interfaces influence users when they evaluate systems. The study found that users socially interact with the systems and the social cues portrayed by the embedded virtual agents influence system users' evaluations of the agents as well as the overall system quality. These studies all support the notion of recommender systems as social actors and suggest a need for examining the social aspects of recommender systems. This implies that recommender systems can be understood as communication sources to which the communication theories developed for human-human communication apply. One set of such theories relates to the impact of source characteristics on persuasion likelihood and outcomes.

20.4 Source Factors in Human-Human Communication

There has been considerable research attention on investigating various communicator characteristics that influence the outcomes of the communicator's persuasive efforts in human-human interactions. This section provides a brief review of the most relevant source factors examined in the literature. Figure 20.1 provides an overview of influential source cues influencing credibility assessment in interpersonal communication.

20.4.1 Source Credibility

A good number of past studies have confirmed that a more credible source is preferred and also more persuasive [4, 49, 58, 78, 90, 136, 137]. Credibility is generally described as comprising multiple dimensions [16, 46, 119, 135] but most researchers agree that it consists of two key elements: expertise and trustworthiness [42, 43, 113, 126]. The dimension of expertise captures the perceived knowledge and skill of the source [85, 113] while trustworthiness of a source refers to aspects such as character or personal integrity [113]. Whether a source is perceived as having expertise and being trustworthy depends to a great extent on its characteristics.

20.4.2 Source Cues

20.4.2.1 Source Likeability

People mindlessly tend to agree with those who are seen as likable [18]. Research generally supports the assumption that liked communicators are more effective

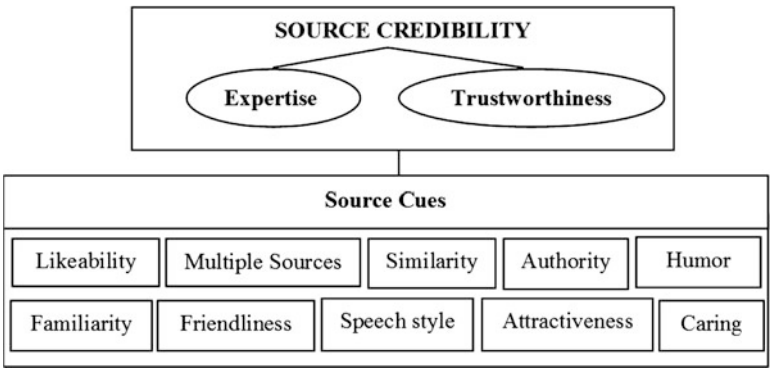

Fig. 20.1 Influential source cues in credibility evaluations

influence agents than disliked communicators [34, 47, 128]. O'Keefe [113] stressed enhanced liking for the source is commonly accompanied by enhanced judgments of the communicator's trustworthiness. Further, a number of studies found that similarity increases likeability [21, 23, 64].

20.4.2.2 Multiple Sources

Social impact theory [67, 79] explains that impact of a persuasive attempt depends on strength, immediacy and number of influencing sources. The theory predicts that the message will be more persuasive when it comes from multiple sources than from a single source. This prediction was supported by several studies that found that a message presented by several different sources was more persuasive than the same message presented by a single source [56, 57, 158]. Such social or group-based information evaluation and credibility assessment is increasingly critical within the context of recent sociotechnical developments. Online users today are naturally social and often access social collaborative efforts to evaluate online source and information credibility [92].

20.4.2.3 Similarity

In general, homophily theory [81] states that humans like similar others. However, the relation between similarity and the dimensions of credibility appears to be complex. Mills and Kimble [93] found that similar others are seen as having greater expertise than dissimilar others. However, Delia [31] observed that similarity between the source and the message receiver makes the receiver see the source less as an expert. In contrast, some studies found that similarity does not make any difference in source expertise judgments (e.g., [7, 147]). The perceived similarity of the message source also has varying effects on perceived trustworthiness of the communicator. O'Keefe [113] suggested that perceived attitudinal similarities can enhance liking for the source that is commonly accompanied by enhanced judgments of the communicator's trustworthiness. However, Atkinson et al. [7] found that ethnic similarity and dissimilarity did not influence the perceived trustworthiness of the source, while Delia [31] observed that similarity sometimes diminished trustworthiness perceptions. O'Keefe [113] noted that the effects of perceived similarities on judgments of communicator credibility depend on whether, and how, the receiver perceives these as relevant to the issue at hand. Thus, different types of similarity likely have different effects in different communication contexts.

20.4.2.4 Symbols of Authority

Evidence presented in the persuasion literature indicates that people often embrace the mental shortcut of assuming that sources who simply display symbols of authority such as titles, tailors and tone should be listened to [13, 48, 63, 120, 126].

A number of studies reported that cues like the communicator's education, occupation, training, amount of experience, and outfit influence a message receiver's perceptions of source credibility [62, 63].

20.4.2.5 Styles of Speech

Several studies suggest that the style of speech can influence speaker credibility judgments. Previous findings indicate that providing both sides of an argument can enhance the trustworthiness of communicators [35, 143] while using complex, difficult-to-understand terms can increase the perceived expertise of speakers [27]. In addition, the fluency of speech [17, 36, 88, 133], speaking rate [1, 53, 80, 83] and citing sources of evidence (e.g., [41, 87, 112]) appeared to influence source credibility evaluation.

20.4.2.6 Humor

Previous studies found effects of humor when message receivers evaluate a communicator's credibility. However, the specific effects varied across different studies. A number of studies found positive effects of humor on communicator trustworthiness judgments but rarely on judgments of expertise [24, 52, 149]. When positive effects of humor were found, the effects tended to enhance the audience's liking of the communicator and this liking helped increase perceptions of trustworthiness. In contrast, some researchers found that the use of humor can decrease the audience's liking for the communicator, the perceived trustworthiness, and even the perceived expertise of the source when the use of humor is perceived as excessive or inappropriate for the context [15, 100, 150].

20.4.2.7 Physical Attractiveness

A number of studies have found that physically attractive communicators are more persuasive [33, 66, 144]. Eagly et al. [33] explained that there appears to be a positive reaction to good physical appearance that generalizes to favorable trait perceptions such as a talent, kindness, honesty and intelligence. The effects of physical attractiveness are seen as influencing indirectly, especially by means of influence on the receiver's liking for the communicator [113].

20.4.2.8 Caring

Caring as a theoretical construct encompasses motives and intentions. Benevolence, which refers to concern about the message receiver's best interest, has been proposed as an underlying dimension of trust [8]. Delgado-Ballester [30]

conceptualizes good intentions as an important factor that determines trustworthiness. Perloff [118] reports that communicators who have the recipient's interests at their heart and communicate goodwill are often evaluated as credible sources.

20.4.2.9 Familiarity and Friendliness

As a rule, individuals are more likely to comply with requests of someone they know in contrast to requests made by strangers [25]. Familiarity itself is very persuasive as people are more prone to like people they know personally [25, 82, 139]. However, also friendly strangers will get a head start. Praise and other forms of positive estimation stimulate liking [22]. Communicators who are nice and friendly can change attitudes because they make the recipient feel good, and the positive feeling becomes transferred to the message [126].

20.4.2.10 Discussion

While these source cues have been identified as influential factors for source credibility in interpersonal communication, the challenge is how these cues can be translated and implemented in the recommender systems context. This area remains underexplored but previous findings of recommender system studies indicate the relevance of interpersonal source cues to recommender systems. For example, a good deal of studies has found effectiveness of collaborative filtering (e.g. [116, 130]) in recommender systems. This implies that similarity and multiple source cues are influential factors in the recommender systems context but the cues are typically not well presented to users. Systems may enhance the impacts of these cues by explaining the similarity algorithm behind the recommendation (e.g. Amazon's explanation of "Customers who viewed this item also viewed"), integrating other users' ratings (e.g. MovieLens) or displaying the number of users who were satisfied with the recommended items. Similarly, symbols of authority could be implemented by displaying third party seals on the system interface or presenting the users' ratings of the system. Recent findings by Shani and his colleagues [138] indicate that users build trust when systems provide a display of confidence alongside a recommendation although the display does not help the users in identifying the recommendation quality and making decisions. Styles of speech cues could be translated into the system's recommendation generation process or presentation style. For instance, a good flow of process or informing users about the search progress could enhance users' overall satisfaction [94]. The format and layout of recommendation presentation also has been found to influence users' perception [141]. Further, styles of speech cues might be easily translated into real systems due to advances in voice technology.

The physical attractiveness of source cues can be related to overall system interface design and the perceived attractiveness of embodied agents. Implementing caring and friendliness cues into the systems is challenging but improved trans-

parency and interactivity of recommender systems can express benevolence/caring towards users. Providing explanations of the reasoning mechanism that generates recommendations can help users to better understand the good intentions and efforts of the system, which helps to determine the trustworthiness of the source [154]. Likewise, systems can implement cues of caring or friendliness when interacting with users. For instance, Amazon's "Improve Your Recommendations" link allows users to be involved in the recommendation generation process and shows the system's concern about users' best interest. The conversation styles of systems or embodied agents can also convey caring and friendliness cues. In addition, familiarity cues could be translated into interface design (familiar interface vs. unfamiliar interface) or by integrating social technologies (recommend items that the users' social media friends have purchased or rated). When translating humor into systems one can benefit from the research on funology. Integrating humor or playfulness into the preference-measurement task might improve users' interaction experience with systems [14, 51]. Fun games can be designed to support the preference elicitation process or humorous virtual agents can be used. Khooshabeh and his colleagues [71] have found that individuals interacting with a humorous virtual agent were more likely persuaded by the agent's suggestions. As discussed above, there are potential approaches to implementing interpersonal source cues in recommender systems. However, many cues have not yet been implemented and empirically tested in the recommender system context. Findings from human-computer interaction studies can further inform such efforts. The following section discusses the source factors examined in human-technology interactions, followed by a systematic overview of source factor-related research in the recommender system realm.

20.5 Source Factors in Human-Technology Interactions

It seems obvious that a computer is a tool or medium and not an actor in social life. However, media equation theory suggests that individuals' interactions with computers, television sets, and new media are fundamentally social and natural, just like interactions in real life [124]. This theory thus argues that the technologies should be understood as social actors, not just tools or media. Based on this paradigm, a growing number of studies have investigated how certain social characteristics of the technologies influence their users' perceptions and behaviors. Similarity between a computer and its users was found to be important when computer users evaluated the computer and its contents [42, 105]. For example, Nass and Moon [105] report that computers conveying similar personality types are more persuasive. In their study, dominant participants were more attracted to, assigned greater intelligence to, and conformed more with a dominant computer compared to a submissive computer. Submissive participants reacted the same way to the submissive computer as opposed to the dominant computer, despite the essentially identical content. Nass et al. [104] also revealed the effects of demographic similarity. Their study found

that computer users perceived computer agents as more attractive, trustworthy, persuasive and intelligent when same-ethnicity agents were presented.

Presenting authority symbols has also been identified as an influential factor when people interact with technology. Nass and Moon [105] found that a television set labeled as a specialist was perceived as providing better content than a television set labeled as a generalist. Fogg [42] also posited that computing technology that assumes roles of authority is more persuasive. He argued that websites displaying awards or third-party endorsements such as seals of approval will be perceived as more credible.

A number of studies [104, 107] argue that the demographic characteristics of computer agents influence users' perceptions. Nass et al. [107] illustrated that people apply gender and ethnicity stereotypes to computers. Specifically, their study found that people evaluated the tutor computer as significantly more competent and likeable when it was equipped with a male voice than a female voice. They also found that the female-voiced computer was perceived as a better teacher of love and relationships and a worse teacher of computing than a male-voiced computer, even though they performed identically. In addition, the use of language such as flattery [44], apology [152] and politeness [86] has been identified as factors which make a difference in computer users' perceptions and behaviors. Further, the physical attractiveness of computer agents was found to matter. The findings by Nass et al. [104] indicate that computer users prefer to look at and interact with computer agents that are more attractive. Finally, humor has also been tested in the human-computer interaction context. Morkes et al. [98] found that computers which display humor are rated as more likeable.

20.6 Source Factors in Human-Recommender System Interactions

A number of previous studies have investigated how specific characteristics of recommender systems influence users' evaluations of the system as well as its recommendations. Existing recommender system studies have examined some source factors identified as influential in traditional interpersonal relations and also identified important source factors that are prominent in recommender system contexts. Xiao and Benbasat [159, 160] classified the various source characteristics that have been studied as being associated with either recommender system type, input, process or output design. Also, with the increasing interest in and use of embodied agents in recommender systems, a considerable number of studies has investigated the effects of characteristics displayed by embodied virtual agents that often guide users through the various steps of the recommender process. More recently, there is growing research attention on factors that have emerged with the rise of social technology. Figure 20.2 provides an overview of source factors identified in contemporary recommender system research. See Chaps. 8–10 for

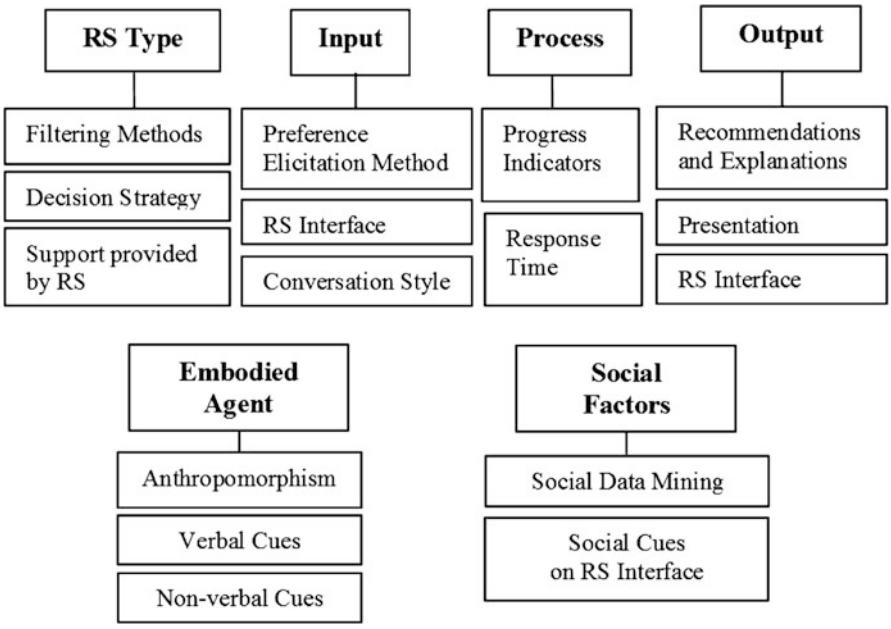

Fig. 20.2 Overview of source factors examined in recommender system research

additional discussions on how to assess the quality and value of recommender systems. For examples of recommender systems used in industrial settings, see Chap. 11.

20.6.1 Recommender System Type

Recommender systems come in different shapes and forms and can be classified based on filtering methods, decision strategies or amount of support provided [159]. A number of previous studies have discussed the advantages and disadvantages of these different types of recommender systems (e.g. [5, 19, 84]). Different filtering methods were compared and it was found that meta-recommender systems that combine collaborative filtering and content filtering are evaluated as more helpful than traditional systems that use a pure collaborative filtering technique [131, 132]. Burke [19] also confirmed that hybrid recommender systems provide more accurate predictions of users' preferences. Regarding the different decision strategies used in recommender systems, compensatory recommender systems have been suggested to lead to greater trust, perceived usefulness and satisfaction than non-compensatory recommender systems [159]. They have also been found to increase users' confidence in their product choices [37]. As far as the amount of support provided by the recommender system is concerned, Xiao and Benbasat

[159] argued that needs-based systems rather than feature-based systems help users to better recognize their needs and more accurately answer the preference-elicitation questions, thus resulting in better decision quality. Needs-based systems are therefore recommended for novice users [38].

20.6.2 Input Characteristics

Input characteristics of recommender systems include those cues that are related to the preference elicitation method, ease of generating new/additional recommendations and the amount of control users have when interacting with the recommender system's preference elicitation interface [159]. A number of previous findings suggest that characteristics associated with recommender system input design influence system users' evaluations. Xiao and Benbasat [159] specifically argued that the preference elicitation method (implicit vs. explicit) influences users' evaluation of the system. They proposed that an implicit preference elicitation method leads to greater perceived ease of use and satisfaction with the recommender system while explicit elicitation is considered to be more transparent by users and leads to better decision quality. Allowing users more control was also found to be an influential factor when evaluating systems. West et al. [157] posited that giving more control to system users will increase their trust and satisfaction with the system. Indeed, a study conducted by McNee et al. [91] found that users who used user-controlled interfaces reported higher user satisfaction than users who interacted with system-controlled and mixed-initiative recommender systems. In addition, users of user-controlled interfaces felt that recommender systems more accurately represented their tastes and showed the greatest loyalty to the systems. Similarly, Pereira [117] demonstrated that users showed more positive affective reactions to recommender systems when they had increased control over the interaction with the recommender system. Komiak et al. [76] also found that control over the process was one of the top contributors to users' trust in a virtual agent. Supporting the importance of user control, Wang [153] noted that more restrictive recommender systems were considered as less trustworthy and useful by their users.

In addition to control, the structural characteristics of the preference elicitation process (relevance, transparency and effort) have also been found to influence users' perceptions of the recommender system [51]. The specific study by Gretzel and Fesenmaier [51] found that topic relevance, transparency in the elicitation process and the effort required by users to provide inputs positively influence users' perceptions of the value of the elicitation process. The findings suggest that by asking questions, the system takes on a social role and communicates interest in the user's preferences, which is seen as valuable. The more questions it asks, the greater its potential to provide valuable feedback. Also, making intentions explicit in this interaction is important. Although trust was not specifically measured, benevolence and intentions are important drivers of trust and can be implied from the importance based on transparency. Further, McGinty and Smyth [89] suggested that

the conversation style of recommender systems during the input process matters. In contrast to Gretzel and Fesenmaier [51], they argued that the comparison-based recommendation approach, which asks users to choose a preferred item from a list of recommended items instead of a deep dialogue approach that asks users a series of direct questions about the importance of product features, would minimize the cost to the user and maintain recommendation quality.

20.6.3 Process Characteristics

Characteristics of recommender systems displayed during the recommendation calculation process appear to influence users' perceptions of the systems [159]. Such process factors include information about the search process and about the system response time. Mohr and Bitner [94] noted that system users use various cues or indicators to assess the amount of effort saved by decision aids. Indicators that inform users about the search progress help them become aware of the efforts saved by the system. The higher users' perceptions of the effort saved by decision aids, the greater their satisfaction with the decision process [11]. Sutcliffe et al. [146] found that users reported usability/comprehension problems with information retrieval systems that did not provide a search progress indicator.

Influences of system response time, i.e. the time between the user's input and the system's response, have also been identified as important in a number of studies. Basartan [10] varied the response time from a simulated shopbot and found that users prefer those shopbots less that make them wait a long time before receiving recommendations. In contrast, Sinha and Swearingen [141, 148] found that the time taken by users to register and to receive recommendations from recommender systems did not have a significant effect on users' perceptions of the system. In the study by McNee et al. [91], the lengthier sign up process increased users' satisfaction with and loyalty toward the system. Xiao and Benbasat [159] explained that the contradicting findings of previous studies regarding response time may depend on users cost-benefit assessments. They suggest that users do not form negative evaluations of the recommender systems when they perceive the benefits of waiting as leading to high quality recommendations. The findings of Gretzel and Fesenmaier [51] regarding the relationship between elicitation effort and the perceived value of the elicitation process support this assumption.

20.6.4 Output Characteristics

Recommender system characteristics portrayed in the output stage of the recommendation process are related to the content and the format of the recommendations presented to users. Previous findings indicate that the content and the format of recommendations can have significant impact on users' evaluations of recommender

systems (e.g. [28, 141, 155, 159]). Xiao and Benbasat [159] noted that three aspects of recommendation contents—the familiarity of the recommended option, the amount of information on recommended products, and the explanation on how the recommendation was generated—are especially relevant when users evaluate recommender systems. Some studies found that more familiar recommendations increase users' trust in the recommender system. Sinha and Swearingen [141] found that recommended products that were familiar to users were helpful in establishing users' trust in recommender systems. A study by Cooke et al. [26] also observed that unfamiliar recommendations lowered users' favorable evaluations of recommender systems. Further, the availability of product information appeared to positively influence users' perceptions of recommender systems. Sinha and Swearingen [141] suggest that detailed product information available on the recommendation page enhances users' trust in the recommender system. Cooke et al. [26] also explained that the attractiveness of unfamiliar recommendations can be increased if recommender systems provide detailed information about the new product.

The impacts of explanations on users' evaluations of recommender systems have been investigated in a considerable number of studies. Wang and Benbasat [154] found that explanations of the recommender system's reasoning logic strengthened users' beliefs in the recommender system's competence and benevolence. Herlocker et al. [60] also reported that explanations were important in establishing trust in systems since users were less likely to trust recommendations when they did not understand why certain items were recommended to them. Bonhared and Sasse [114] emphasized that recommender systems must establish a connection between the advice seeker and the system through explanation interfaces in order to enhance the user's level of trust in the system. Similarly, studies by Pu and Chen [121] and Tintarev and Masthoff [151] showed that system users exhibited more trust in the case of explanation interfaces.

The format in which recommendations are presented to the user also appears to influence users' evaluation of recommender systems. Sinha and Swearingen [141] found that navigation and layout of recommendation presentation interfaces significantly influence users' satisfaction with systems. Swearingen and Sinha [141] further found that interface navigation and layout influenced users' overall rating of systems. Consistent with these findings, Yoon and Lee [164] showed that interface design and display format influenced system users' behaviors. However, a study conducted by Bharti and Chaudhury [12] did not find any significant influence of navigational efficiency on users' satisfaction. In addition, Schafer [129] suggested that merging the preferences interface and the recommendation elicitation interface within a single interface can make the recommender system be seen as more helpful since this new "dynamic query" interface can provide immediate feedback regarding the effect caused by an individual's preference changes. Since this merges the input with the output interface, this suggestion touches upon cues such as transparency already discussed in the context of input characteristics.

20.6.5 Characteristics of Embodied Agents

Recommender systems often include virtual personas guiding the user through the process. It can be assumed that social responses are even more prevalent if the system is personified. Indeed, the important role and impacts of embodied interface agents in the context of recommender systems have recently been emphasized in a number of studies. For example, the presence of a humanoid virtual agent in the system interface was found to increase system credibility [99], to augment social interactions [122], to enhance the online shopping experience [65], as well as to induce trust [156]. With growing interests in such interface agents, a number of studies have started investigating if and how certain characteristics of the interface agent influence recommender system users' perceptions and evaluations.

One of the important identified characteristics of agents is anthropomorphism. Anthropomorphism is defined as the extent to which a character has either the appearance or behavioral attributes of a human being [74, 109–111]. Many researchers have found that anthropomorphism of embodied agents influences people's interactions with computers (e.g. [74, 109, 111]), and specifically with recommender systems [122]. Yet, the benefits and costs of anthropomorphic agents are debatable. For example, more anthropomorphic interface agents were rated as being more credible, engaging, attractive and likeable than less anthropomorphic agents in some studies [74, 110] while other studies found contrasting results [101, 109, 111]. The social cues communicated by the inclusion of such agents might create expectations in the users that cannot be met by the actual system functionalities.

Human voice is a very strong social cue that has been found to profoundly shape human-technology interactions [102]. However, findings in the context of embodied interface agents are not widely available and are currently inconclusive. The voice output of interface agents was found to be helpful in inducing social and affective responses from users in some studies [97, 122] but other studies found that sociability is higher when the system avatar only communicated with text [145].

The demographic characteristics of interface agents have also been found to influence system users' perceptions and behaviors. Qiu [122] reports that system users evaluated the system as more sociable, competent, and enjoyable when the agents were matched with them in terms of ethnicity and gender, thus supporting the homophily hypothesis. Cowell and Stanny [29] also observed that system users prefer to interact with interface characters that matched their ethnicity and were young looking. A study by Nowak and Rauh [110] indicated that people showed a clear preference for characters that matched their gender.

In addition to similarity cues, other source characteristics have also been investigated in the context of embodied interface agents. The effects of attractiveness and expertise of interface agents were tested by Holzwarth et al. [65]. They found that an attractive avatar is a more effective sales agent at moderate levels of product involvement while an expert agent is a more effective persuader at high levels of product involvement. Further, the potential impacts of nonverbal behavior cues

including facial expression, eye contact, gestures, paralanguage and posture of interface agents were emphasized by Cowell and Stanney [29]. However, research in this area is still limited.

20.6.6 Impact of Emerging Social Technologies

Social technologies and recommender systems benefit mutually from each other [55]. On the one hand, recommender systems embedded in social technologies alleviate information overload for social technology users by presenting only relevant and personalized content [54, 55, 167]. On the other hand, recommender systems can integrate new social media-generated data such as tags, ratings and comments to enhance the quality of their recommendations. These social media-generated data can play an important role in recommender system credibility assessments.

Metzger and her colleagues [92] found that a growing number of online users make information evaluations and credibility assessments using cues provided by social technologies. They argued that, today, source credibility is no longer evaluated by just one person but rather collaboratively. Zhou and his team [167] specifically examined the benefits of exploiting social content/data in recommender systems. They explained that social technologies contain data that can be mined and analyzed to expand user profiles, and to build complex maps of user-to-user and user-to-interest relationships. Their argument is that recommender systems can generate high quality and reliable recommendations by incorporating social data more effectively via the use of the latest collaborative filtering approaches, data mining techniques, and trust/reputation management technology. Indeed, a study by Guy and his colleagues [55] found that recommender system users showed greater interest in items recommended by systems that combined related people and tags data in order to generate recommendations. In addition, Armentano et al. [6] found that system users often perceived recommendations as relevant when the system generated the recommendations using an algorithm based on the social network structure of users. Further, Guy and Carmel [54] noted that the system should provide explanations of how and why the specific recommendations were presented to users to increase the level of trust in the system. In summary, there is increasing evidence that social cues generated by social technology matter for credibility assessments. See Chap. 15 for additional discussions on social recommender systems.

20.7 Discussion

Swearingen and Sinha [141] noted that the ultimate effectiveness of a recommender system depends on factors that go beyond the quality of the algorithm. Nevertheless, recommender system features are oftentimes implemented because they can be

implemented. They might be tested in the course of overall system evaluations or usability studies but are rarely assessed in terms of their persuasiveness. Häubl and Murray [59] demonstrated that recommender systems can indeed have profound impacts on consumer preferences and choice beyond the immediate recommendation. Thus, conceptualizing recommender systems not only as social but also as persuasive actors is crucial in understanding their potential impacts. The above review of the literature suggests a wide array of recommender system characteristics which could be influential.

Following the paradigm of "Computers as Social Actors" [42, 124], recent recommender system studies have started emphasizing the social aspects of recommender systems and stress the importance of integrating social cues to create more credible and persuasive systems [3, 122, 154]. This recognition of recommender systems as social actors has important implications for recommender systems research and design. Most importantly, conceptualizing human-recommender system interactions as social exchanges means that important source characteristics identified as influential in traditional advice seeking relationships can also be seen as potentially influential in human-recommender system interactions.

20.8 Implications

Understanding the influence of source characteristics when evaluating recommender systems has many implications of theoretical and practical importance. From a theoretical perspective, the classic interpersonal communication theories need to be expanded in scope and applied to understand human-recommender system relationships. By applying classic theories, researchers can test and examine various aspects of human-recommender system interactions. However, the unique qualities of human-recommender interactions should be considered when applying these theories and when developing methodologies to test them. Further, while some recommender system-related research exists with respect to source characteristics, the efforts are currently not very systematic and sometimes inconclusive. Clearly, more research is needed in this area so that a strong theoretical framework can be built.

From the practical perspective, understanding recommender systems as social actors whose characteristics influence user perceptions helps system developers and designers to better understand user interactions with systems. Social interactions thrive on trust and are also subject to persuasion. The way in which preferences are elicited, the way recommendations are derived, and the more insight users have in these processes, the greater perceptions of credibility and the greater the likelihood for a recommendation to be accepted [51]. Opposed to the common practice of one-shot interactions, recommender systems would be more probable to trigger a social frame in the minds of users if their conceptualization and design were more ambitious with respect to the consideration of the different source factors:

RS Type and Input Hybrid systems, explicit elicitation and generally giving users control over the process seem to be highly effective strategies [19, 77, 91, 117, 131, 132, 157, 159]. Seen from an abstract viewpoint two basic conversational strategies have been explored in recommender systems: asking and proposing. *Asking* denotes the explicit elicitation of user preferences in order to compute recommendations [166]. The *Proposing* conversation strategy is also known as critiquing, where one or more items are presented and the user can provide feedback why a specific item does not exactly match the user's preferences [20]. One of the earliest systems combining both strategies, i.e. first asking users about their preferences and then making several rounds of propositions which can be critiqued, is the ExpertClerk system [140]. Another system suggested by Schafer [129] has a dynamic query interface, that merges the preferences interface and the recommendation elicitation interface within a single user interface. This helps users feel that they have control over the system since the interface can provide immediate feedback regarding the effects caused by individuals' preference changes.

Process During interaction with recommender systems, response times needs to be kept short [10] and the specifics of the search process should be communicated to users [11, 94, 146] to demonstrate the system's efforts as this will influence credibility perceptions.

Output When generating recommendations, more familiar recommendations with detailed product descriptions [26, 141] and explanations regarding the underlying logic of how the recommendation was generated [45, 60, 154] would increase users' perceived credibility of the system. A good understanding of users' system use history and patterns using a sophisticated data mining technique would help the systems generate recommendations that are more familiar to users. Along with the text descriptions of recommended products, recommender system designers may consider providing virtual product experiences. Jiang and Benbasat [70] noted that a virtual product experience enhances consumers' product understanding, brand attitude, purchase intention as well as decreases the perceived risks. Adding virtual experiences of products enables the users not only to have a better understanding of the recommended products but also to inspire greater attention, interest and enjoyment.

Recommender system designers should also pay attention to the display format of the recommendations [141, 164]. Navigational efficacy, design familiarity and attractiveness need to be considered when the recommendations are presented to users. The challenge for design is to find ways in which source characteristics such as similarity, likeability and authority can be manipulated and translated into concrete design features that fit within the context of recommender systems. For instance, presenting third party seals signaling the authority of the system can increase the overall credibility of systems.

Embodied Agent One way in which some characteristics can be more easily implemented is by adding an embodied agent to the system interface. The embodied agent serves as the representative of the system and, thus, emphasizes the social

role of the system as the advice giver [163]. Voice interfaces can be another way to translate source characteristics into credibility-evoking recommender system design, for instance one very recent work combines speech interaction with a conversational critiquing strategy [50]. Manipulating personalities (e.g. extraversion or introversion) of recommender systems to match with users' personalities by varying communication style and voice characteristics was also suggested by Hess et al. [61] and Moon [95].

Social Factors The first authors envisioning collaborative recommender systems [125] already had a clear social perspective of this technology in mind, which might influence the social structure among its users by fracturing the global village into smaller tribes. Since then the paradigm shift that came along with social web applications turns information seekers and consumers also into information contributors. The Social Web therefore not only became a rapidly growing application domain in order to support users in digging through the enormous information offerings, but also a precious source for making algorithms more accurate (see [68] for a quantitative survey on domains of interest to recommender systems research). However, purposefully exploiting social cues to develop more credible and persuasive recommender systems is still in its infancy. From the marketing point of view, creating recommender systems that play similar roles as human salespersons in physical stores who interact with consumers and advise consumers in terms of what to buy continues to be an important goal [75, 76].

20.9 Directions for Future Research

While existing studies have identified and tested a number of influential source characteristics in human-recommender system advice seeking relationships, many potential characteristics suggested by general communication theories such as authority, caring, non verbal behaviors like facial expression and gestures, and humor have not been examined. Those unexamined characteristics need to be successfully implemented and also empirically tested in future recommender system studies. The identified and tested source characteristics also need to be more precisely examined. The effects of source characteristics on judgments of source credibility are often found to be complex rather than linear in previous studies conducted in human-human advice seeking contexts [113]. Since situational factors, individual differences and product type can also play a significant role in determining the recommender system credibility, relationships will have to be specifically tested for specific recommender systems to provide accurate input for design considerations. The increasing use of recommender systems through mobile devices warrants particular attention in this context. In addition, there can be additional source characteristics that might not be prominent in influencing advice seeking

relationships among human actors but are important aspects to be considered in the realm of recommender systems. For instance, anthropomorphism of the technology has been identified as an important characteristic that influences interactions with technologies [74, 111] while it is of course not a critical characteristic in interactions among human actors. The realness of interface agents can also be considered as a potentially influential source cue. There is some evidence that users are less likely to respond socially to a poor implementation of a human-like software character than to a good implementation of a dog-like character [72]. Cues generated by social technology also fall into this category. In future research, such additional source cues need to be identified and tested.

Some of the source characteristics have been tested in isolation from another. In order to investigate interaction effects, different source cues should be tested simultaneously if it is possible to implement them at the same time. This will help with understanding the relationships among various source factors.

Overall, the literature presented in this chapter suggests that there is a great need for research in this area. It also suggests that new methodologies might have to be developed to investigate influences that happen at a sub-conscious level. Especially a greater emphasis on behavioral measures of recommendation acceptance seems to be warranted if the persuasiveness of recommender systems is to be evaluated.

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