



# A Model for Information Behavior Research on Social Live Streaming Services (SLSSs)

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**Abstract.** Social live streaming services (SLSSs) are synchronous social media, which combine Live-TV with elements of Social Networking Services (SNSs) including a backchannel from the viewer to the streamer and among the viewers. Important research questions are: Why do people in their roles as producers, consumers and participants use SLSSs? What are their motives? How do they look for gratifications, and how will they obtain them? The aim of this article is to develop a heuristic theoretical model for the scientific description, analysis and explanation of users' information behavior on SLSSs in order to gain better understanding of the communication patterns in real-time social media. Our theoretical framework makes use of the classical Lasswell formula of communication, the Uses and Gratifications theory of media usage as well as the Self-Determination theory. Albeit we constructed the model for understanding user behavior on SLSSs it is (with small changes) suitable for all kinds of social media.

**Keywords:** Social media · Social live streaming service (SLSS)  
Live video · Information behavior · Users · Lasswell formula  
Uses and gratifications theory · Motivation · Self-determination theory

## 1 Introduction: Information Behavior on SLSSs

On social media, users act as prosumers [1], i.e. both as producers of content as well as its consumers [2]. Producers usage [3] amalgamates active production and passive consumption of user-generated content. Social Networking Services (SNSs) are social media in which prosumers communicate among each other with the help of texts, images and videos. Typical examples of SNSs are Facebook<sup>1</sup> and Vkontakte<sup>2</sup> (in Russia and neighboring countries) [4]. Facebook-like SNSs are asynchronous [5], which means that the producer of the content acts at another time than the consumer of that content. There is (or, better, there can be) a closed circle of communication, if the consumer reacts to the producer's content by commenting, liking or sharing the information and if the producer gains knowledge about those acts. As the communicative acts take place in the passage of (maybe long) times, communication happens

<sup>1</sup> <https://www.facebook.com/>.

<sup>2</sup> <https://vk.com/>.

slowly. With the advent of social live streaming services (SLSSs) [6], communication between all involved prosumers comes to real-time meeting.

Social live streaming services such as, for instance, Periscope<sup>3</sup>, Ustream<sup>4</sup>, YouNow<sup>5</sup>, YouTube Live<sup>6</sup>, Facebook Live<sup>7</sup>, Instagram Live<sup>8</sup>, niconico<sup>9</sup> (in Japan), Yi-ZhiBo<sup>10</sup>, Xiandanjia<sup>11</sup>, Yingke<sup>12</sup>, YY Live<sup>13</sup> (all in China) or – for broadcasting e-sports resp. drawing – Twitch<sup>14</sup> and Picarto<sup>15</sup> are social media, which combine Live-TV with elements of Social Networking Services including a backchannel from the viewer to the streamer and among the viewers. SLSSs allow their users to broadcast their programs to everyone who wants to watch, all over the world. The streamers film either with the camera of a mobile phone or with the aid of a webcam. Some SLSSs employ elements of gamification (especially YouNow; Fig. 1) to motivate their users to continuously apply the service. The main feature of SLSSs is the simultaneity of the communication, as everything happens in real time. Summing up, SLSSs are social media platforms with the following characteristics:

- SLSSs are synchronous,
- they allow users to broadcast their own program in real-time (as in TV),
- users employ their own mobile devices (e.g., smartphones, tablets) or their PCs and webcams for broadcasting,
- the audience is able to interact with the broadcasting users and with other viewers via chats,
- some SLSSs support gamification mechanics and dynamics, and
- the audience may reward the performers with, e.g., points, badges, or money.

What information behavior do prosumers exhibit on SLSSs? In line with Bates [7] and Wilson [8] we define “information behavior” as all human behavior with relation to information and knowledge (HII: Human Information Interaction) or to information and communication technologies (HCI: Human Computer Interaction). As information behavior on SLSSs is always computer-mediated, it is subject of HCI by definition. Fisher, Erdelez and McKechnie [9, p. xix] conceptualize information behavior “as including how people need, seek, manage, give, and use information in different contexts.” Similarly, Robson and Robinson [10, p. 169] propose an information

<sup>3</sup> <https://www.pscp.tv/>.

<sup>4</sup> <http://www.ustream.tv/>.

<sup>5</sup> <https://www.younow.com/>.

<sup>6</sup> [https://www.youtube.com/channel/UC4R8DWoMol7CAwX8\\_LjQHig](https://www.youtube.com/channel/UC4R8DWoMol7CAwX8_LjQHig).

<sup>7</sup> <https://live.fb.com/>.

<sup>8</sup> <https://help.instagram.com/292478487812558>.

<sup>9</sup> <http://www.nicovideo.jp/>.

<sup>10</sup> <https://www.yizhibo.com/>.

<sup>11</sup> <http://www.xiandanjia.com/>.

<sup>12</sup> <https://www.inke.cn/>.

<sup>13</sup> <http://www.yy.com/>.

<sup>14</sup> <https://www.twitch.tv/>.

<sup>15</sup> <https://picarto.tv/>.

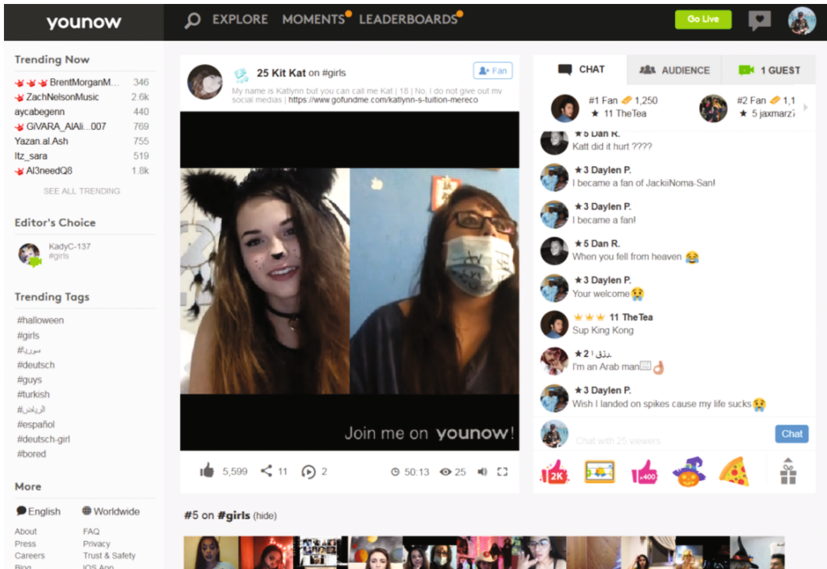


Fig. 1. Live stream on YouNow (split screen of broadcaster and one participant)

behavior model that “takes into account not just the information seeker but also the communicator or information provider.”

The aim of this article is to develop a heuristic model for the scientific description, analysis and explanation of prosumers’ information behavior on social live streaming services in order to gain better understanding of the communication patterns in real-time social media. Why do some people broadcast live – even slices of their own lives similar to Truman Burbank (in the movie “The Truman Show” – please, have in mind that Truman was not fond of it in the end) [11]? Why do people watch such streams? And why do some people participate in the communication by giving “hearts,” comments or gifts? What are the users’ motivations as producers, consumers and participants? Does gamification help to motivate prosumers to use an SLSS and to lock the users to the service?

In order prepare the ground to answer these questions empirically, we are going to develop a theoretical framework for understanding information behavior on SLSSs building on the classical Lasswell formula of communication, the Uses and Gratifications theory of media usage and the psychological theory of Self-Determination.

## 2 The Lasswell Formula of Communication

In a first rough differentiation, we distinguish between sender-centered and audience-centered communication models as in SLSSs both aspects, namely senders (i.e., broadcasters) and viewers (i.e., audience) are equally important. One of the classical sender-centered models is the theory of Harold D. Lasswell. Lasswell [12, p. 37] introduces the following questions:

- Who
- Says What
- In Which Channel
- To Whom
- With What Effect?

This five questions lead to five sub-disciplines of communication science, which however can definitely cooperate. “Scholars who study the ‘who,’ the communicator, look into the factors that initiate and guide the act of communication. We call this subdivision of the field of research *control analysis*. Specialists who focus upon the ‘says what’ engage in *content analysis*. Those who look primarily at the radio, press, film and other channels of communication are doing *media analysis*. When the principal concern is with the persons reached by the media, we speak of *audience analysis*. If the question is the impact upon audience, the problem is *effect analysis*” [12, p. 37]. Braddock [13] adds two further questions:

- What circumstances?
- What purpose?

The extended Lasswell formula reads as follows: “WHO says WHAT to WHOM under WHAT CIRCUMSTANCES through WHAT MEDIUM for WHAT PURPOSE with WHAT EFFECT” [13, p. 88]. In terms of Braddock, the *Who* is the communicator (in SLSSs, the broadcaster); he/she acts as an individual or as a representative of a group. The *What* is the message with the two inseparable aspects of content and presentation (in SLSSs, the content and style of the broadcast). To *Whom* asks for the audience and its characteristics (in SLSSs, the viewers of the broadcast). *What Circumstances* concerning SLSSs analyzes the environment of the broadcasting act in terms of time and setting. One question Braddock asks is, “Was the communicator in a position in which he was forced or expected to say something? Was he acting as a spokesman for a group, being paid to say something, being influenced by superiors ...?” [13, p. 91]. In SLSSs, for describing and analyzing influencers or micro-celebrities, for instance, it seems to be very important to realize the exact setting of the broadcast. *What medium* includes questions on the information channel. “Does it imply a mass or selected audience? ... Can the audience see the communicator’s expression, gestures, dress, and so on? ... Does the medium require oversimplification of the message?”, Braddock asks [13, p. 92]. *What Purpose* means the communicator’s motives to communicate. What does the communicator want the audience to do? Interestingly, Braddock only makes mention of the motives of the communicator, but not of the audience. Concerning SLSSs, we have to study the broadcasters’ motivations to produce and to perform a live stream. The last aspect *What Effect* analyzes the outcomes of the entire communication process for the audience. What are the reactions of the SLSSs’ audience when they consume a live video? The entire process is a linear sequence of building blocks of the communication [14, p. 14] (Fig. 2). This representation of communication is quite similar to the signal transmission process as described by Shannon [15]; however, we have to add the component of knowledge as the content of information to Shannon’s more technologically oriented model [16, p. 36].

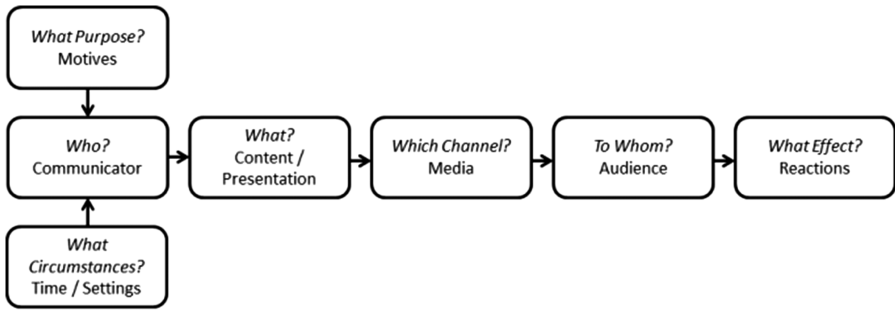


Fig. 2. The communication process according to Lasswell and Braddock

Concerning Lasswell, circuits of communication are one-way or two-way, depending upon the degree of reciprocity between communicators and audience [12]. Given that there is an audience for a live stream, on SLSSs communication is always two-way and thus reciprocal. This means that the roles between communicator and audience can change; the original communicator will become audience when the viewer reacts to his/her message (or his/her appearance), and that the original audience may communicate with the original communicator and – what is very special to SLSSs – with the rest of the audience.

The Lasswell formula found application in the study of communication via social media and user-generated content. Wenxiu [17] transferred the model from “classical” mass media (as TV) to “new media” (as Internet and its services); Jan [18] developed an analytical framework for research on enterprise social media; and Auer [19] discussed political motivated content leading to influence the audience while using social media. However, scholars were able to identify problems in Lasswell’s model of the five (with Braddock’s additions, seven) W-questions if applied to understand communication on social media. “Lasswell’s ‘5W’ model lacks feedback, and the role of communicator and audience is rigid, the interactivity of new media provides the communication study lots of new inspiration,” Wenxiu states [17, p. 249]. Similarly, Jan questions the linear relationship in the Lasswell formula. Instead, new media “are likely to reshuffle the dynamics of existing and future communication processes” [18, p. 11]. Therefore, we turn our attention to audience-centered communication models.

### 3 Uses and Gratifications

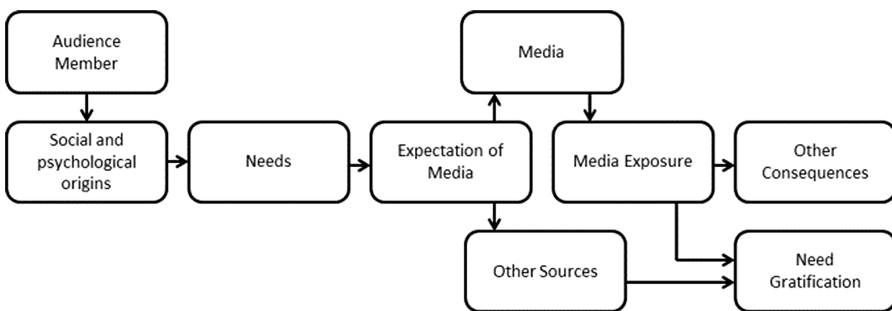
In sender-centered communication models, the starting point is the active communicator, and the audience remains more or less passive. By contrast, audience-centered models place special emphasis on the receivers. In the Uses and Gratifications approach by Elihu Katz and colleagues [20, 21] “the ‘needs’ of the individual form the starting point” [14, p. 135]. “Audience activity is central to uses-and-gratifications research, and communication motives are key components of audience activity,” Papacharissi and Rubin define [22, p. 175]. Klapper [23, p. 525] works out the difference between the Lasswell formula and Uses and Gratifications theory clearly: “We are fond of

saying that mass communication research used to be directed to the question of ‘What does mass communication do to people?’ but that uses-and-gratifications study ask, more sensibly, ‘What do people do with mass communication?’.” However, for Klapper (as for us as well), there is no contradiction between both views as they complement each other. “A valid view of audience behavior lies somewhere between these extremes [of the “passive” and the “active” audience],” Rubin adds [24, p. 98]. The uses and gratifications theory remains successful in the study of media effects till today [25–27].

For Katz, Blumler, and Gurevitch [20, p. 510], there are seven steps in the audience’s media usage:

- the social and psychological origins of
- needs, which generate
- expectations of
- the mass media or other sources, which lead to
- different patterns of media exposure, resulting in
- need gratifications and
- other consequences (including unintended ones).

Researchers may study the audience’s needs and then uncover how they are gratified by the media. Or vice versa, we observe gratifications and look for the needs that are gratified. Of course, researchers may analyze the social and psychological origins of audience expectation and gratifications as well [20, p. 510]. It is important to realize that the need gratification and the media choice are strongly dependent on the single concrete audience member – so we have to be very careful when generalizing audience data into hypothesis or theories. All media compete with other sources of gratification, e.g. with face-to-face contacts with other people or with playing with toys [20, p. 511]. We tried to visualize the media usage steps in Fig. 3.



**Fig. 3.** The communication process according to Katz, Blumler, and Gurevitch

We have to distinguish between two aspects of gratifications. When there are needs and expectations of media, audience members seek for gratification. After media exposure, they find gratifications. According to Palmgreen et al. [28] there is a

feedback loop between the gratifications sought and the gratifications obtained (Fig. 4). “Over time we would expect such feedback processes to result in a rather strong relationship between sought and obtained measures for a particular gratification as long as the seeking behavior is reinforced” [28, p. 164]. It is possible, for instance, to seek for information; however, after media exposure not obtaining the anticipated information but finding entertainment. For Palmgreen et al. [28, p. 164] it is an important research question, “are the *dimensions* of gratifications of gratification *sought* from a particular medium, content type, or program the same as the *dimensions* of gratifications perceived to be *obtained*?”

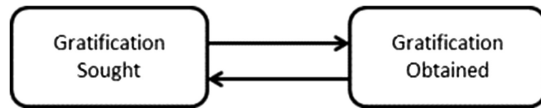


Fig. 4. Gratification sought and obtained according to Palmgreen, Wenner, and Rayburn II

What types of gratification are identified in communication science? Blumler and Katz [29] and later MacQuail [30] found four basic dimensions of gratifications:

- information,
- personal identity,
- entertainment as well as
- integration and social interaction.

*Information* means the motive of finding knowledge; *personal identity* is related to our motive to define our identity; *entertainment* comprises escaping from problems, relaxing, filling time, or sexual arousal; *social interaction* is the motive to interact with other people.

However, mediated social interaction is different from “normal” social interaction. Basic elements of “normal” social interaction are bodily contact, proximity, orientation, gesture, facial expression, eye-movement as well as verbal and non-verbal aspects of speech [31]. An audience member, say of a TV show and its actors, does sometimes not only passively consume the show, but he or she builds up a kind of relationship to an actor, presenter or celebrity [32]. The “media figure” is not aware of a relationship, but only the spectator. Horton and Wohl [33] name such mediated social interactions “parasocial interactions.” The crucial difference between social interactions and parasocial interactions “lies in the lack of effective reciprocity,” establishing an “intimacy at a distance” [33, p. 215] as bodily contact is not given as well. In mediated contexts, the fourth dimension of gratification is *parasocial interaction*.

There are other classifications of basic gratifications. It is possible to sort all motivations into the five categories of cognitive, affective, personal integrative and social integrative motivations as well as into the motive of tension release [20].

Use of social media is not the same as use of TV [34]. With Joinson [35] we can distinguish between content gratifications (gratifications based upon the content of the watched media), process gratifications, which are based on the actual experience of

using the media, and – which is new on the Web – social gratifications (or gratifications in a “social environment” [36]), based upon communication and integration.

TV-oriented communication research predominantly studied the behavior of the audience. On social media, one can figure out three different roles of people [37, p. 15]:

- consumers (or lurkers),
- participators and
- producers.

For Shao [37] *consumers* only receive content and do not contribute to the communication processes. *Participators* do not initiate content communication, but they “take advantage of user-generated sites to interact with the content and other human beings” [37, p. 18]. Lastly, *producers* “produce their own contents” [37, p. 18]. All three groups of people look for and obtain gratifications.

The dimension of personal identity has to be broadened in social media. Producers and participators as well can and will articulate their personal identity. They are actively acting and presenting themselves. So we should better speak about “self-presentation” in this dimension.

Uses and Gratifications theory found and finds many diverse applications in social media research. There are numerous studies about uses and gratifications on, for instance, SNSs as Facebook [35, 38], MySpace [39] or professional SNSs [40], microblogging services as Twitter [41] or Weibo [42] and sharing services as Instagram [43] or YouTube [44]. Additionally, there are lots of papers on Uses and Gratifications concerning other Web services, e.g. messengers as WhatsApp [45] or WeChat [46].

## 4 Self-determination: Needs, Motivations and (Maybe) Flow

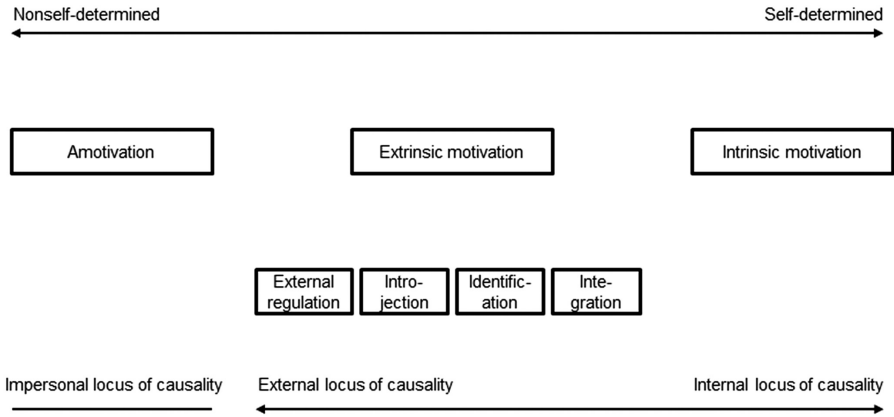
In the Uses and Gratifications theory, there is an important building block of the model called “needs.” Without human needs there will be no media production or media reception. To clarify the function of needs, we turn towards Self-Determination theory, originated by Ryan and Deci [47–49]. Self-Determination theory – as a theory of human motivation [50] – seems to be an ideal psychological addition to communication science approaches as the Lasswell formula and the Uses and Gratifications theory [51].

For Ryan and Deci [47, p. 10], needs are defined as “nutrients that are essential for growth, integrity, and well-being.” There are three basic needs; *autonomy* is the need to self-regulate own experiences and actions; *competence* is the need to act efficiently and to master all important life contexts; finally, *relatedness* concerns feeling socially connected, belonging to a community and feeling significant among others [47, pp. 10–11]. Needs lead to motivations. Motivations concerns “what ‘moves’ people to action” [47, p. 13], they “energize” and give directions to human behavior. Ryan and Deci distinguish between three regulatory styles of motivation, namely

- intrinsic motivation,
- extrinsic motivation (integration, identification, introjection, external regulation), and
- amotivation [52].



Motivations are determined either by the acting persons themselves (self-determination) or by other circumstances (nonself-determination). Those circumstances include other people as loci of causality or nonpersonal loci. There are no clear boundaries between self-determination and nonself-determination, but a continuum of the degree of (non-)self-determination of motivations. Apart from intrinsic motivations (which are always caused by internal aspects, i.e. by the acting persons' selves), motivations are caused by a combination of internal and external aspects (Fig. 5).



**Fig. 5.** Human motivations in the self-determination continuum following Ryan and Deci

Intrinsic motivation “involves people freely engaging in activities that they find interesting, that provide novelty and optimal challenge” [49, p. 235]. Intrinsically motivated human behavior is performed out of the acting person’s interests, for which the primary rewards are the confirmation of one’s own competence or simply enjoyment. Following Vallerand [53], there are three types of intrinsic motivations, namely to cause an activity for pure joy, to understand something new, and to arrive at an accomplishment (for the process to create something new).

While intrinsic motivations are autonomous by definition, extrinsic motivations vary “widely in the degree to which they are controlled versus autonomous” [47, p. 14]. Deci and Ryan distinguish four kinds of extrinsic motivations. *Integration* means the internalization of extrinsic causes. “When regulations are integrated people will have fully accepted them by bringing them into harmony or coherence with other aspects of their values and identity” [49, p. 236]. The external aspects of motivation are fully transformed into self-regulation resulting in self-determined extrinsic motivation. *Identification* is the adoption of external regulations for a special purpose. “For example, if people identified with the importance of exercising regularly for their own health and well-being, they would exercise more volitionally” [49, p. 236]. While integration and identification are more related to a person’s self-determination, introjection and external regulation are more caused by external and nonself-determined aspects. *Introjection* entails the actor’s taking in external regulations and the reaction

on contingent consequences of those regulations. Prototypical examples of introjection are actions leading to the person's pride or refraining actions which could end in the person's feelings of shame or guilt. The "classic case" of extrinsic motivation is the *external regulation* "in which people's behavior is controlled by specific external contingencies" [49, p. 236]. People behave to get rewards or to avoid negative consequences – independently of their own preferences or norms.

Intrinsic as well as all types of extrinsic motivations represent personally caused actions (internally caused by the actor or externally by others). Amotivation lacks such external personal aspects. Amotivation leads to non-activity, i.e. to refrain from an action. Deci and Ryan identified three forms of amotivation, namely a felt lack of competence, a lack of interest, relevance or value, and the defiance or resistance to influence (which can also be seen as motivated nonaction) [47, p. 16].

For Max Weber, "action is 'social' insofar as its subjective meaning takes account of the behavior of others and is thereby oriented in its course" [54, p. 4]. Information behavior on social media in general and also in SLSSs in particular is partly oriented on the behavior of others. So it is social action. For social actions, there are no intrinsic motivations causing the information behavior on social media, because intrinsic motivations are autonomous and therefore not oriented towards the behavior of others as a matter of principle. Of course, all not explicitly socially oriented actions on social media may be caused by intrinsic motivations.

If we combine the sought as well as the found gratifications adopted from Uses and Gratifications theory with the motivations identified from Self-Determination theory, we have to ask for each gratification (information, self-presentation, parasocial interaction, and entertainment), what type of intrinsic or extrinsic motivation (or amotivation) is realized in the concrete situation.

However, there is another form of motivation found on some information systems, namely motives driven by gamification [55]. The implementation of game mechanics and dynamics in non-game contexts is used to increase one's engagement, motivation and activity. Therefore, Web information systems and mobile applications already utilize it [56]. For Deterding [57], gamification means designing for motivation to adopt and to repeatedly use an information system. Typical gamification elements for producers and for participants on SLSSs are, for example, getting fans (becoming a fan), getting positive comments (giving comments), receiving gifts (making gifts), getting subscribers (becoming a subscriber) as well as getting shares and likes (giving shares and likes). For consumers (as well as for the other two groups) gamification elements as rankings, levels, coins or badges are possibly motivating.

Sometimes, media producers, participants or consumers may experience total absorption in an activity as well as the non-self-conscious enjoyment of it. Csikszentmihalyi [58] called such an optimal experience "flow." Flow can be reached if there is an optimal challenge. "Too much challenge relative to a person's skills leads to anxiety and disengagement, whereas too little leads to boredom and alienation" [49, p. 260]. Flow theory is compatible with Self-Determination theory, as Deci and Ryan state, "(w)hen people experience flow, their activity is said to be autotelic, which means that the purpose of the activity is the activity itself, and we often spoke of flow as the prototype of intrinsically motivated activity" [49, p. 260].

## 5 The Model

Paraphrasing Klapper [23], on social media, with user-generated content, we study what people do with social media *and* what social media do with the people. In “classical” communication science as of Lasswell or Katz we spoke of the “audience” of media (especially of TV), with the advent of the internet and especially of the social media the term changed to “users” [34, p. 505]. Nowadays, on social media, audience members are *users*. However, in SLSSs, they are very special users. As SLSSs combine (live) TV with social media the people working with SLSSs are both, TV audience and social media users. In this way the different research lines of communication science (studying the audience) on the one side and of HCI research (studying users) on the other side get together.

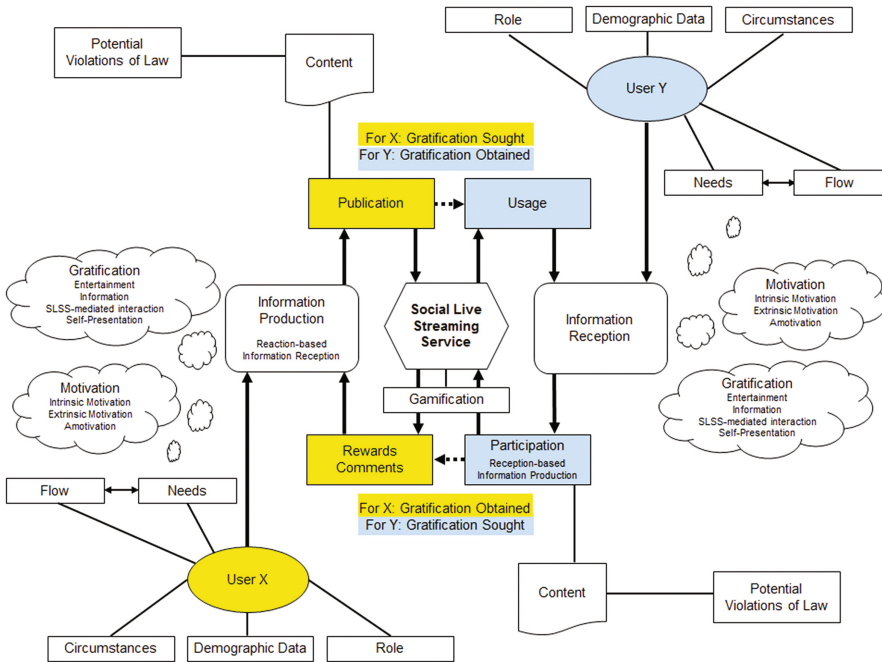
The special position of SLSSs in the field of all social media is mirrored by the kind of social interaction. While all parasocial interaction (on TV as well as on social media, but not on SLSSs) lacks proximity, and bodily contact, and (in many cases) reciprocity, SLSS-mediated interaction may be reciprocal, if the producer and the participant communicate live via the system. Of course, also on SLSSs there is no spatial proximity; however, there is a temporal proximity as all happens real-time (Table 1). So, SLSS-mediated interaction is closer to “normal” social interaction than to parasocial interaction.

**Table 1.** Forms of interactions

	Reciprocity	Spatial proximity	Temporal proximity	Bodily contact
Social interaction	Yes	Yes	Yes	Yes
Parasocial interaction	Sometimes	No	No	No
SLSS-mediated interaction	Yes	No	Yes	No

In Fig. 6 (flowchart) and 7 (database model), users search for intrinsically or extrinsically motivated gratifications through entertainment, information, SLSS-mediated social interaction, and self-presentation or through gamification elements (insofar provided by the service). In our flowchart, user X is a producer and user Y a participant. If another user Y’ stops at the building block “information reception,” she or he is a consumer.

In Fig. 6, you will find the building blocks of the Lasswell/Braddock model (from Fig. 2) on the way from user X (Who?), his/her motives (What purpose?) and the circumstances of the communication act (What circumstances?) via the production of a publication, i.e. a live video, with its particular content (What?), distributed on an SLSS (Which Channel?) to the information receivers Y or Y’ (To Whom?) and their reactions (What Effect?). The Uses and Gratifications approach (from Fig. 3) starts with user Y resp. Y’ (Audience member). The model stresses the importance of user characteristics as the circumstances, demographic data and the user’s role/s in the entire



**Fig. 6.** Building blocks of information behavior on SLSSs as a flowchart

communication process (Social and psychological origins) as well as the user’s motivation (Needs).

Former experiences with SLSSs (and other social media) lead to certain Expectation of Media and the use of SLSSs (Media exposure) or alternatively the use of Other Sources, leading to the satisfaction of the motivation (Need gratification) and to Other consequences (e.g., changing leisure behavior due to stark SLSS usage). Of course, our model also considers the relation between gratifications sought and gratifications obtained (from Fig. 4).

SLSSs offer spectators the possibilities to (only passively) view a video (as user Y’ does) or to (actively) participate as a guest in a live stream (as in Fig. 1), to write chat messages and to reward the streamer (so does user Y). Producers (as our user X) interact with the viewers in real-time through their publications, i.e. their live streams. Additionally, they read the chat messages of the participants (now acting as consumers) and can instantly respond in their stream (now acting as participants). Gratification is sought by streaming (user X), by watching (user Y’) as well as by commenting and donating (user Y); gratification is found by the satisfaction of one’s motives. Therefore, user X will be satisfied when viewers react to the streams and reward him or her; user Y will be satisfied when the streamer or other viewers react to the comments resp. to the rewards; finally, user Y’ will be satisfied when she or he receives the wanted live video.

Producers as well as participants distribute content. It is possible that this content is “contaminated” with juridical problems. If music is playing while broadcasting, this

could be a copyright infringement. If the video shows other people without their written permission, say on a street, this is an object of personality rights violation.

Finally, users have characteristics, most important their roles (as producers, participants, or consumers), their gender, their nationality, and their age resp. their generational cohort. Additionally, we have to consider specific circumstances, in which the users behave and which influences the users' information behavior, e.g. their position as opinion leaders [59], influencers [60], micro-celebrities [61] or as stakeholders of companies, political parties or religious associations. On SLSSs, only producers are identifiable, while consumers and participants may stay anonymous. Also on other social media, users can decide whether they want to act identifiable or to remain anonymous. However, on some specific social media, e.g. Jodel<sup>16</sup> or the closed down service Yik Yak, users are always anonymous. As anonymity has impact on the information behavior of the users, the model has to pay attention to this differentiation.

The aim of the entity-relationship model [62] corresponding to our flowchart, is to describe the inter-related information of our specific domain of knowledge, the information behavior of SLSSs' users (Fig. 7). This way, we are able to generate a database which can hold lots of data for easy access and future analyses. The entity 'Consumer' is in relation to the entity 'Social Live Streaming Service,' since we want to analyze which user interacts with which kind of SLSSs. It would have been possible to attach the entity 'Social Live Streaming Service' to the 'Live-Stream' entity as an attribute, but we wish to gain insight into the gamification elements that influence the user and this relation would be lost, since a game mechanic is not attached to a stream per se, but to the SLSS. Analyzing the demographic data of a 'Consumer' (age, gender, country), and if the user was anonymously online, for which we chose Boolean values, is also our goal. Since flow is a state which is experienced or not we likewise chose Boolean values to answer if the user was immersed in the stream. We want to further inquire the motivational aspects and the different forms of gratifications a user searches for and in return receives, so we added the attributes 'Motivation,' 'Gratification sought' and 'Gratification obtained' which will later be filled with the applicable norm entries corresponding to the Self-determination and the Uses and Gratifications theory by the researchers.

Since the participant is a consumer who also writes comments, thus interacts with the stream, and a producer is a special form of participant who creates live-streams and can be an influencer, micro-celebrity or other kind of personality, we choose to implement 'is-a'-relationships to better distinguish between the three kinds of users of an SLSS. Further research could focus on the comments the participant writes during a live-stream, so we save the content of the comments and what kind of user writes them.

We are interested in different aspects of a live-stream; its duration, number of viewers, the number of likes, as well as the content, and therefore added attributes for them. Furthermore, since each live-stream can display several breaches of the law, we implemented them as an entity for easier analyses.

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<sup>16</sup> <https://jodel.com/de/>.

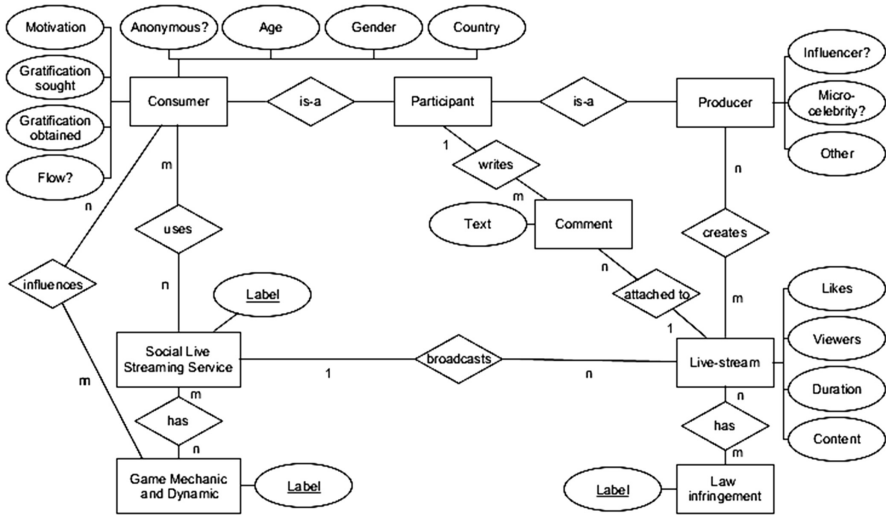


Fig. 7. Information behavior on SLSSs as entity-relationship model

## 6 Measuring Information Behavior on SLSSs

All building blocks depicted in Figs. 6 and 7 are measurable. However, how? How can we arrive at sound data on information behavior on SLSSs? As HCI and communication researchers, we are able to use four different sources for data gathering, namely (1<sup>st</sup>) log files of the information systems, (2<sup>nd</sup>) performing experiments with probands in controlled test situations, (3<sup>rd</sup>) asking the users (by quantitative surveys and qualitative interviews), and, finally, (4<sup>th</sup>) systematic observations of the streams.

As log files’ data are not very meaningful (it is impossible to get data on users’ motives and streams’ content) we can only use this source for some basic data as, for instance, for describing few user characteristics (e.g., country of dial-up) and some technical interaction data (e.g., time spent on the SLSS) [63, 64].

If we are able to identify certain dimensions of information behavior it is possible to analyze those variables in a test situation. Wilk, Wulfert, and Effelsberg [65], for instance, performed experiments on the behavior of SLSS viewers concerning the effects of gamification elements. With experiments, it is possible to arrive at precise data on single variables; however, as the data were collected in a controlled situation, they are not necessarily the same outside the laboratory. To cover real-life information behavior, researchers have to go into the “wilderness,” i.e. they have to study (real) users when they interact with (real) information services.

With Katz et al. [20, p. 511] we believe, that “people are sufficiently self-aware to be able to report their interests and motives in particular cases.” Therefore SLSS researcher may conduct online surveys with SLSS users as participants and perform qualitative interviews with prototypical users. Indeed, many empirical investigations on SLSSs made use of surveys, for instance, concerning Twitch [66–69] or general SLSSs as YouNow [6, 11, 70], the former services Qik [71] and Meerkat [72], the Chinese

SLSSs Douyu TV and YY Live [73] as well as live streams via SNSs [74]. Additionally, there are surveys on the information behavior of special user groups as, e.g., teens [75].

As a further methodological approach, researchers will realize systematic observations of a sufficiently large amount of streams and evaluate the videos' content as well as the streamers' motivations (insofar they are observable) via content analysis [76, 77]. If there are open questions during the observations the researchers are able to ask both, the streamers as well as the viewers, during the live-sessions. We found some content analyses on SLSSs, e.g. analyzing user-generated content on YouNow [78] or comparing content on Periscope, Ustream and YouNow [79, 80]. Additionally, one may statistically analyze the word distribution of the chats [81].

The main perspective of our theoretical models is the *user* of an SLSS and her or his *information behavior* concerning the services and their environment. If we turn the angle to an evaluation of the *information service*, we are able to identify additional theoretical models which help us to structure research tasks on SLSSs. Until today many different evaluation models (among others, TAM, TAM 2, TAM 3, UTAUT and MATH) have been developed to measure the quality and acceptance of these services. However, those models consider only subareas of the whole concept that represents an information service. As a holistic and comprehensive approach, the Information Service Evaluation (ISE) model [82] studies five dimensions that influence adoption, use, impact and diffusion of the information service: information service quality, information user (here is the contact area with the information behavior models), information acceptance, information environment and time. All these aspects have a great impact on the final grading and of the success (or failure) of the service. Concerning SLSSs, ISE found application in an evaluation of the general SLSS YouNow [11, 70].

**Table 2.** Theoretical foundations of SLSS studies

	Examples
Lasswell formula	[83]
Uses and gratifications theory	[66–68]
Self-determination theory	[69]
Theory of flow	[74]
Information service evaluation model	[11, 70]

## 7 Conclusion

The aim of our article was the development of a heuristic theoretical model for the scientific description, analysis and explanation of users' information behavior on SLSSs in order to gain better understanding of the communication patterns in real-time social media. Our theoretical framework makes use of the classical Lasswell formula of communication, the Uses and Gratifications theory of media usage as well as the Self-Determination theory (including the theory of Flow). Additionally, we shortly mentioned the ISE model to consolidate studies on the information service. In the

current literature on SLSSs, indeed all addressed theories and models could be identified (Table 2); however, in most cases only one of the theories.

The combined model of information behavior on SLSSs (as shown in Figs. 6 and 7), if necessary connected with the Information Service Evaluation model, has two main advantages:

- it addresses all building blocks of the entire communication process on SLSSs (leading scientists simply not to forget important research aspects),
- it establishes a common basis for comparable results from different research teams.

Albeit we constructed the model for understanding user behavior on SLSSs it is (with small changes) suitable for all kinds of social media. As other social media are mostly asynchronous, there is no direct backchannel from the audience to the producers. However, the building blocks of the research model will be the same for most of the known social media services.

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