REFLEXIVE MODELS AND EPISTEMIC APPROACH IN SOCIAL MEDIA MARKETING

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1. **Introduction**

Social Media Marketing (SMM) is very important part of the contemporary marketing [20]. The Basic idea lies in the fact that we cannot ignore social structure of people. It is not about personal characteristics of people because Direct Mail have been handling it for many years but not enough for social networks. Different reputation of different people is more close idea but it is not enough since targeting has been known for many years but it does not suit social networks in a best way. The key idea is that any direct effect on a group of people with social structure will lead to indirect side effect of their interaction and this interaction is very complex and based of game theory mechanisms, phycology and other things. The details and the illustrations one can find in [14-17].

In this paper, we focus on reflexive and epistemic features. The most simple and direct way is to think about it as a special graph based math tool to handle linguistic and philosophical features as “What do I know about what Alice knows what Bob knows what I knows about … Alice knows”. Similar idea could be described in humanities way not technical if we consider sych structure “What do I feel about what Alice feels what Bob feels what I feel about … Alice feel about this”.

Our paper structured into following parts. In section 2 we describe an example of SMM to have something to start with. Then, in section 3, we show one of the ways of thinking about reflexive analysis in general.

We used a lot of example cases as well as very abstract ideas to attach to any types of readers. We also shows many diagrams without large description since they are very informative and useful to be mentioned but there is no enough place in paper to dive deeper. We placed the most specialized information into Appendixes. The most part of those descriptions are taken from already published papers but due to their importance, they were attached to this paper. We are not pretending that these results are ours.

1. **An example of business process of a typical SMM activity** 
   * Preliminary phase
     + Analysis of market and Focus group
     + Analysis of Product
     + Analysis of KPI of marketing activities
   * Creating and application of marketing strategy for SMM
     + Creating marketing strategy for SMM
     + Creating focus group
     + Gathering a team
   * Creating communities if there were no
     + Include influential person with good reputation
     + Including active and famous persons to spread information
     + Everyday work
     + Observing trends
     + Creating content
       - * Idea or fact
         * Design
     + Placing content
     + Follow up posts: analysis and commenting
   * Creating a report
2. **A process of using reflexive and epistemic analysis**



Fig 1. A process of using reflexive and epistemic analysis

1. **Motivating examples**

There are several very attractive examples for deep math analysis:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Case | Example | What is a cost of our fault if we act wrong? | What do we need? | What reflexive and epistemic approaches could provide? / What kind of models suits the best? |
| Wars of brands | BMW vs AUDI, Democrats vs Republicans | Our reputation. | Predict next move from your opponent and reaction of our potential clients. | We can represent activity of brand owners as a game of brands. This is a rank game. That has a common idea with the “Beauty Context”game. |
| Reaction of clients | Victoria’s secret brand | Potential lose a part of our market | Values and reasoning, decision making of our clients | Multiple informational structure based on values of people could provide us an instrument to carefully take care of this effects. |

Table 1.



Fig. 2. An example of brand vs brand war.



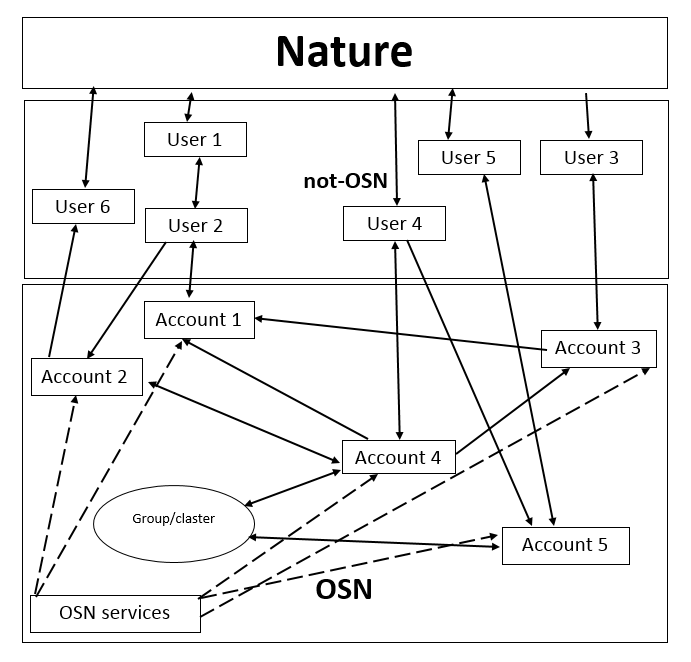
Fig. 3. An example of brand vs brand war.



Fig.4. An example of brand vs brand war.

1. **The Big picture**

One can define a Social Media [1, 2] as a special type of interaction between online social network (OSN) and its users. Usually one can include a very important part – reality or nature.



State of nature

non

Fig. 5.

We can describe structure of this environment by a directed graph. One can easily see that this any element from E can have a link to an element from N and any element of N could have a link to an object in E. We can schematically write it as E↔N. An agent has a link to an event means that the agent is involved in this event. An event has a link to an agent then this means that an agent can receive an information from about this event or this event influences the agent.

Similar any element from N can have a link to an element from A and any element of A could have a link to an object in N. We can schematically write it as N↔A. An agent has a link to an account if and only if the agent is involved in control of this account as a member of a management team like PR agency. An account has a link to an agent if it is by a person that is associated with this account for example by name or surname.

Similar A could have links with G. We can schematically write it as A↔G. An account could influence group and a group could influence an account. We treat influence as a term that describes a non-empty set of situation when one can change others’ behavior or state.

An account or a group has a link to a service if he controls it. We can schematically write it as A↔S and G↔S. A service has a link to a group if it use its information or can directly influence on this account by some information or other ways.

We can summarize some issues in a ontology that we represent by tables 2 and 3.

|  |  |  |  |
| --- | --- | --- | --- |
|  | E | N | A |
| Events (E) | - | takes part,  producing [3] | ? |
| Agents (N) | get information,  is influenced | - | can use information about the certain real person like name, hobbies etc. [3] |
| Accounts (A) | availability depends on this event | can create,  controls, manages | - |
| Communities (G) | can be a result of public events like studying in the same school | can create,  controls, manages | can take part in discussions |
| Services (S) | make news,  gives direct link to information from nature | get information |  |

Table 2.

|  |  |  |
| --- | --- | --- |
|  | G | S |
| Events (E) | ? | provides statistics |
| Agents (N) | provides expert opinions | coordinates, influences [4] |
| Accounts (A) | provides discussions | provides statistics |
| Communities (G) | - | provides statistics |
| Services (S) | ? | - |

Table 3.

1. **User properties**

In social psychology, a common method of analyzing the potential variability of personal characteristics in a social environment employs the *Johari method*  (see. Fig. 4). It was named after Joseph Luft and Harrington Ingham.

|  |  |  |
| --- | --- | --- |
| Others  **I** | What others know about myself | What others don’t know about myself |
| What I know about myself | I | **II** |
| What I don’t know about myself | **III** | **IV** |

Table 4. The Johari window.

This tool is a part of reflexive analysis. What information could be placed in Johari window for SMM?

Please note that for brand wars it is important to know answers to these questions of focus group but also a reprehension of these answers in your rival’s strategy.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | User | Why? | When? | How? | Where? | What |
| 1 | Exists |  | Have good enough devices and time | By creating an account once | In a few network | - |
| 2 | Is identified | Wants to spread influence | When most his friends are | By photo, identification number | In friend list and in global search | Name and photo, friends |
| 3 | Get message | Want to find for new information | Several times a day | By signal from a device |  | Spam, new useful information. |
| 4 | Activates | A dangerous tendency that he wants to avoid | Messages that he likes or doesn’t like | Change his opinion or get a pleasure |  | Decision rule, activity |
| 5 | Share with others activity | With all friends | Activates too much | By using a share button |  | A post that illustrates a dangerous tendency that he wants to avoid |
| 6 | Modify before sharing | To emphasize details |  | Adding own text |  | Posts |
| 7 | Change behavior for (1)-(6) |  |  |  |  |  |

Table 5. An example of focus group profile. Please note that due to reflexive analysis such profiles of other focus groups plays an important role too by social influences our focus group.

1. **Reflexive models and epistemic approach to services and knowledge.**

Since we have some review of importance of this analysis we can know borrow deeper in review of features and definitions of reflexive and epistemic analysis.

Let us focus on service and more generally on information [6, 7] and knowledge [13] and believes [9]. There are several ways of describing knowledge and logical ones are very important.

The following description was taken from [8]. Besides common deGroot [5] and epidemic approaches, there are many epistemic models and different ways of its graphical representation. Some of them are based on formal modal logic [13] – others are not. We consider two of the m – one epistemic and one reflexive. These models are probably equivalent since they have some different terms for the same objects and at the same time the similar terms for different ones – e.g. both are based on the concept of possible worlds which was used by Hintikka, Lenzen, Aumann.

Term “epistemic” is very widely used – one can find many publications. In this paper, we will only focus on models that are based on Kripke model and logic e.g. dynamic epistemic logic, public announcement logic etc. In our work, we use the terms possible worlds and logical statements as synonyms in the way proposed by Aumann– the world is possible if this logical statement is true in this world. It is of a great help to us when proving some theorems because we avoid the need to analyze any logical statement according to specific rules – we just need to understand what worlds this statement eliminates (enumeration of these worlds is not necessary). It helps to handle some of the problems that are described in [5] by finding exact analytical solution for some special cases.

Reflexive approach is well known in Russia for historical reasons but usually its usage is bounded by this region. Since term “reflection” we will use not in sense of algebraic properties or medical term but is epistemic sense. We tell more about if what sense we use it.

The term “reflection” was first suggested by J. Locke. However, in different philosophical systems (the ones by J. Locke, G. Leibniz, D. Hume, G. Hegel, etc.), reflection has various interpretations. In psychology, systematical treatment of reflection dates back to the 1960s (V. Lefebvre’s scientific school). There are not many scientific publications treating this subject but there are a few. The distinctive feature of reflexive approach is a widely used term “phantom agent”. There are two large and very different branches - V. Lefebvre’s scientific school and approach that was introduced and now is developing by Institute of Control Science. In this paper, we decided to use “reflexive” approach because it provided us with a simpler way of graphical visualization of dynamic.

Both epistemic models based on Kripke model and models of “reflexive” approach provide tools for solving problems of epistemic planning.

We also have to take into account cognitive biases [12, 13].

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**Appendix 1. Formal notations.**

In a very naïve and simple way [10], one can create a model for social activity [2 ] in a OSN and close to it (pic. 1).

Let *E*={1, …, *e*} – is a set of events in a nature that we take into account, *N*={1,…, *n*} – a set of agents, *A*={1,…*a*} – a set of OSN accounts, *G*={1,…, *g*} – a set of groups, news groups communities and others similar communities in OSN that are subsets of *A*. Let *S* = {1, …, *s*} - are services of OSN.

**Appendix 2. Control problems.**

It is taken from [15, 19].



Fig. 6.



Fig. 7.



Fig. 8.

**Appendix 3. Creating content (pre-theory of memes).**

It is taken from [19].

Let us need to create a story that could sale our product or strengthen our brand. This classification is taken from a book [].

At first, let us distinguish between internal conflicts and external conflicts between heroes in our story. The former are realized by a subject within his/her aware-ness (i.e., incorporate conflicts arising between components of his/her own awareness structure). The latter occur between components of the awareness structures of the subject and his/her environment. Therefore, four components of awareness (see the shaded ones in Fig. 62) admit six types of conflicts. Below we mention them and provide examples.

There exist three types of internal conflicts:

1. The mismatch between H and HH–an internal conflict between a hero and his/her beliefs about himself/herself. For instance, consider almost all literary works created by F.M. Dostoevsky (the master and wizard of self-reflexion effects); Childhood, Boyhood, and Youth by L.N. Tolstoy; all works belonging to the genre of confession, including St. Augustine Aurelius, A. Musset, J.-J. Rousseau, L.N. Tolstoy, N.A. Berdyaev, and others.

2. The mismatch between H and HEH–an internal conflict be-tween a hero and his/her beliefs about his/her role (in the eyes of an environment). The examples are The Hero of Our Time by M.Yu. Lermontov (the character of Pechorin); The Adolescent by F.M. Dostoevsky, Father Gorio by H. de Balzaq (the character of E. de Rastignac), and others.

3. The mismatch between HH and HEH–an internal conflict be-tween the values of an environment and a hero (according to the latter). Here the examples are Crime and Punishment, Notes from Underground, The Gambler, Demons by F.M. Dostoevsky; Princess Mary by M.Yu. Lermontov; Lady Macbeth of Mtsensk by N.S. Leskov; Lost Illussions by H. de Balzaq; most authors of marginal literature, namely, F. de Sade, H. Miller, V. Erofeev, and others.

In addition, there exist three types of external conflicts:

4. The mismatch between H and EH–an external conflict be-tween a hero and the beliefs (requirements) of an environment about him/her. For instance, Woe from Wit by A.S. Griboedov (the character of Chatsky), Notre Dame de Paris by V. Hugo; many classic literary works of Russian and foreign realism: L.N. Tolstoy (e.g., Three Deaths, The Death of Ivan Ilych, etc.), I.S. Turgenev, M.E. Saltykov-Shchedrin, J.B. Molière, P. Corneille, J. Racine, and others.

5. The mismatch between HH and EH–an external conflict be-tween the beliefs of a hero about himself/herself and the beliefs about him/her by an environment. Here we mention Eugene Onegin by A.S. Pushkin; The Hero of Our Time by M.Yu. Lermontov (the characters of Grushnitsky and Pechorin); Rudin by I.S. Turgenev, Beltov by A.I. Herzen, and others.

6. The mismatch between EH and HEH–an external conflict be-tween the beliefs of an environment about a hero and the vision of these beliefs by the hero. See The Inspector-General by N.V. Gogol (the character of Хлестаков); The Little Tragedies by A.S. Pushkin; Gobseck by H. de Balzaq, and others.

These six types of conflicts are typical in classical literature. The matter turns out somewhat simpler in modern literature. Most plots belong to one of the following types: “Detective story,” “Spy story,” “Eternal triangle (or polygon).”

**Appendix 4. Balancing budget (the content is taken from a book []).**

It is taken from [19].

Consider a model, where an agent purchases a certain product based on his/her preferences and on the information about the share of other agents planning such purchase. Interestingly, most advertising campaigns can be described by the model of informational control with agents’ Reflexion of rank 1 or 2.

Suppose that there are agents of two types. The ones having type 1 incline to purchase products regardless of advertising, while agents of type 2 would not. Denote by *θ*∈ [0; 1] the share of type 1 agents. Type 2 agents (their share makes up (1–*θ*)) are subject to advertising effect; however, they do not comprehend this. Let us reflect social impact as follows. Assume that type 2 agents choose the action *a* with the probability *p*(*θ*) and the action the action *r* with the probability 1–*p*(*θ*). The relationship *p*(⋅) (the choice probability as a function of the share of type 1 agents) characterizes their reluctance of being contrarians.

Imagine that the actual share *θ* of type 1 agents forms a common knowledge. Then agents expect that *θ* agents purchase the product. Nevertheless, in reality they observe that the product is purchased by

(1) *x*(*θ*)=*θ*+(1–*θ*)*p*(*θ*)

agents (by supposition, agents do not realize the advertising effect). Since ∀*θ*∈ [0; 1]: *θ* ≤ *x*(*θ*), the indirect social impact becomes assuring: “Look, more people incline to purchase the product than we expected!”

To proceed, we analyze an asymmetrical awareness. Type 1 agents choose their actions independently. Thus, they can be treated as having an adequate awareness about the parameter *θ* and the beliefs of type 2 agents.

Consider the model of informational regulation, where a principal (an organizer of an advertizing campaign) forms the beliefs *θ*2 about the parameter *θ* for type 2 agents.

Making a small digression, discuss the properties of the function *p*(*θ*). Suppose that *p*(⋅) is a nondecreasing function on [0; 1] such that *p*(0)=*ε*, *p*(1)=1–*γ* . Here *ε* and *δ* indicate constants belonging to unit segment, *ε*≤ 1–*δ*. In practical interpretation, *ε* corresponds to “mistakes” of some type 2 agents (they purchase the product, even believing that the rest agents have type 2). The constant *δ* characterizes (in a certain sense) agents’ susceptibility to influence. Indeed, a type 2 agent has a chance to be independent (by refusing to purchase, even if he/she believes that the rest agents will purchase the product). The special case of *ε*=0, *δ*=1 describes independent agents of type 2 (who deny the purchase).

Agents have no idea of manipulation by the principal. Thus, they expect that *θ*2 agents will purchase the product. Actually, they observe the share of purchasers

(2) *x*(*θ*,*θ*2)=*θ*+(1–*θ*)*p*(*θ*2).

Suppose that the principal’s income is proportional to the share of agents purchasing the product and the advertising costs *c*(*θ*,*θ*2) represent a nondecreasing function of *θ*2. Consequently, the principal’s goal function (the difference between the income and costs) without advertising is defined by (1). Under the advertising campaign, it takes the form

(3) Φ(*θ*,*θ*2)=*x*(*θ*,*θ*2)–*c*(*θ*,*θ*2).

Hence, the efficiency of informational regulation can be defined as the difference between (3) and (1). Accordingly, the problem of informational regulation is rewritten as

(4) Φ(*θ*,*θ*2)–*x*(*θ*)→**.

Now, let us address existing constraints of the problem (4). The first constraint lies in *θ*2∈[0; 1] (more specifically, *θ*2 ≥*θ*).

Consider an example. Set *p*(*θ*)=**, *c*(*θ*,*θ*2)=(*θ*2––*θ*)/2**, where *r*>0 specifies a constant. Then the problem (4) is reduced to

(5) (1–*θ*)(**–**)–(*θ*2–*θ*)/2**→**.

Solution to the problem (5) takes the form *θ*2(*θ*)=max{*θ*;*r*(1– *θ*)2}, i.e., informational regulation becomes pointless for the principal if *θ*≥** (the advertising costs are not compensated, since sufficiently many agents purchase the product without advertising).

Now, besides *θ*2∈[*θ*;1], require stability of an informational equilibrium. Under observability of the share of product purchasers, assume that type 2 agents observe the actual share of product purchasers (if it is smaller than the share reported by the principal). Notably, the stability condition acquires the form *x*(*θ*,*θ*2)≥*θ*2. Using (2), we obtain:

(6) *θ*+(1–*θ*)*p*(*θ*2) ≥*θ*2.

Hence, the optimal stable solution of the informational regulation problem follows from maximizing the function (4) subject to the constraint (6).