

Cybernetic view on creation of political message

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Abstract. In the article we consider how political messages are created by politicians who want to achieve the support, votes and popularity of the society. This complex problem appears to be an inverse (in some sense) to the classical message transmission problem considered in the Shannon-Wiener information theory. Using this observation we show how the message could be created.

Key words: political messages, information theory, coding, decoding, optimization, hermeneutics.

1. Introduction

With the opening of new channels of communication between politicians and the society (electronic media) a traditional form of the message conveyed by a politician to the society, without “beating about the bush”, has gone out of date. A politician soliciting for the support of the society has to address different social strata with the messages that are not always coherent and sometimes may be even contradictory. For instance, “You must steal your first million” will be addressed to the business people and “We will fight with pathologies” to the honest people. Famous “I am for and even against” is a fine example of it. Without making a decision whether such a condition is good or bad for contemporary societies we think that: 1) it should be revealed to the public, 2) it should be demonstrated that seemingly “wrongly presented” (unable to solve and thus artificial) problem of the creation of not coherent message can be sometimes presented systematically and solved. It proves not only that there exists a mathematical object called the solution of the problem but also shows that it can be used in practice in political life. Civil society should be aware of the possibilities of manipulation which a politician has thanks to electronic media.

In the article we are going to consider the problem of the creation of political message understood as the whole of the activities of a politician which are addressed to the society aiming at winning its support, votes, achieving popularity. The messages can be the speeches (e.g. the expose of Prime Minister), press conferences, radio and TV interviews, particular political decisions announced to the public. Messages are addressed to different social strata W_1, \dots, W_n , whose fractions p_1, \dots, p_n , are defined by the formula

$$p_i = \frac{\#W_i}{\#W_1 + \dots + \#W_n}.$$

Assume, that each social stratum has its own way of messages decoding and extracting the true intentions included in the message \varkappa . This is closely related with the so called **hermeneutical horizon** \mathfrak{H}_i (see [1–4]), of a given social stratum. The extraction of the true intention β_i included in \varkappa ,

which was addressed by politician to W_i , is very similar to decoding operation considered in the classical Shannon-Wiener information theory. Denote this operation by f_i , i.e., $f_i(\varkappa)$ is an extracted intention decoded by the social stratum W_i . By $\mathfrak{I}(\mathfrak{H}_i)$ we denote a set of all intentions which can be decoded by W_i according to the hermeneutics horizon limitation. Here $\mathfrak{I}(\mathfrak{H}_i)$ plays a role of constrains in classical optimization problems. A politician knows f_i for some $i \in \{1, \dots, n\}$, (an efficient politician even for most of them), and understand that \varkappa should be created in such a way, that

$$f_i(\varkappa) \in \mathfrak{I}(\mathfrak{H}_i)$$

hold for as large number of W_i (having a large p_i) as possible, since then he can expect that his intentions are widely recognized and approved. Denote by \mathfrak{R} a set of all messages, and assume that the set of all intentions is a metric space (\mathfrak{S}, ρ) with a metric ρ . Additionally, we assume, that

$$\mathfrak{I}(\mathfrak{H}_i) \subset \mathfrak{S}$$

and

$$f_i(\mathfrak{R}) \cap \mathfrak{I}(\mathfrak{H}_i) \neq \emptyset$$

for all $i = 1, \dots, n$, where \emptyset denotes an empty set.

2. Problem

A politician is conscious that his intentions are decoded inaccurately. His aim is to create a message $\varkappa \in \mathfrak{R}$, such that the important intentions β_1, \dots, β_n , included in it and addressed to the society, could be decoded with a minimal error. This leads to the constrained optimization problem of the form

$$\min \left\{ \sum_{i=1}^n p_i \rho(\beta_i, f_i(\varkappa)); \varkappa \in \mathfrak{R} \right\} \quad (1)$$

if $f_i(\varkappa) \in \mathfrak{I}(\mathfrak{H}_i)$ holds for every $i = 1, \dots, n$. If the condition $f_i(\varkappa) \in \mathfrak{I}(\mathfrak{H}_i)$, holds for some $i \in I \subset \{1, \dots, n\} = J$, (a politician addresses his message to a part of the society only), then a more general version of the above is needed. For example, a following criterion can be used

$$K(\varkappa) = \sum_{i \in I} p_i \rho(\beta_i, f_i(\varkappa)) + \sum_{i \in J \setminus I} p_i d$$

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where

$$d = \begin{cases} \sup \{ \rho(x, y) ; x, y \in \mathcal{I} \} & \text{if } \sup \{ \rho(x, y) ; x, y \in \mathcal{I} \} < \infty \\ \text{sufficiently large} & \\ \sup \{ \rho(x, y) ; x, y \in \mathcal{I} \} = \infty. & \end{cases}$$

3. Analogies with the Shannon-Wiener information theory

In the simplest variant of this theory (see [5]) one considers the following scheme of messages transmission. A message β is compressed and coded. Next, the result $f(\beta)$ is sent from a source (N) via a communication channel (where it is corrupted by noise ε), to a receiver. Hence, the receiver (R) obtains the message

$$\varkappa = f(\beta) + \varepsilon.$$

Knowing the code f and the message \varkappa , his aim is to reconstruct β with a minimal error.

If the coding operation is linear, i.e., $f(\beta) = X\beta$, where $\beta \in \mathbb{R}^m$, X is a $n \times m$ -matrix, $\varkappa, \varepsilon \in \mathbb{R}^n$, and $|X^T X| \neq 0$, then $\hat{\beta}$ which minimizes a mean square error

$$\|\varkappa - X\beta\|^2 \tag{2}$$

where $\|\cdot\|$ is a norm in \mathbb{R}^n , is given by the formula

$$\hat{\beta} = (X^T X)^{-1} X^T \varkappa \tag{3}$$

where $(X^T X)^{-1}$ is the inverse of $X^T X$. Moreover, if noises covariance matrix is diagonal

$$\text{cov}(\varepsilon, \varepsilon) = \sigma I$$

where $\sigma = \text{var}(\varepsilon_i)$, and I denote identity matrix, then errors covariance matrix has the form

$$\text{cov}(\varkappa - X\hat{\beta}, \varkappa - X\hat{\beta}) = \sigma [I - X(X^T X)^{-1} X^T]$$

and the minimal error of reconstruction (decoding) is

$$\mathbb{E} \|\beta - \hat{\beta}\|^2 = \sigma \text{Tr} (X^T X)^{-1}$$

where $\text{Tr} (X^T X)^{-1}$ denotes a trace of $(X^T X)^{-1}$, and \mathbb{E} is the expectation with respect to a probability measure.

Remark. Comparing the problems considered in sections two and three, we note analogies and differences between them and recognize that they are in some sense inverse to each other. Indeed, in contrary to the scheme considered in the classical IT, message transmissions between politicians and societies are not corrupted by noises and each social stratum receives **identical** message \varkappa . Moreover, a decoding operation $f_i(\varkappa)$ for the problem (1) in the section two, has the explicit representation (3) for the problem (2).

Conclusion. Hence, assuming temporarily, that $\beta_i \in \mathbb{R}^m$, X_i is $n \times m$ -matrix, $\varkappa, \varepsilon \in \mathbb{R}^d$, then the political message creation problem in its simplest form (without hermeneutics constrains), can be stated in the form

$$\min \left\{ \sum_{i=1}^n p_i \|\beta_i - X_i \varkappa\|^2 ; \varkappa \in \mathbb{R}^d \right\}. \tag{4}$$

Setting

$$\beta = \text{col}(\sqrt{p_1}\beta_1, \dots, \sqrt{p_n}\beta_n)$$

$$X = \begin{bmatrix} \sqrt{p_1}X_1 \\ \dots \\ \sqrt{p_n}X_n \end{bmatrix}$$

and assuming $|X^T X| \neq 0$, we have from (3) immediately

$$\hat{\varkappa} = (X^T X)^{-1} X^T \beta,$$

$$\text{cov}(\beta - X\hat{\varkappa}, \beta - X\hat{\varkappa}) = \sigma [I - X(X^T X)^{-1} X^T], \tag{5}$$

$$\mathbb{E} \|\beta - X\hat{\varkappa}\|^2 = \sigma [nm - \text{Rank} [X(X^T X)^{-1} X^T]].$$

Hence, the politician should use the code

$$K = (X^T X)^{-1} X^T,$$

obtaining $K\beta = (X^T X)^{-1} X^T \beta$, and transmit the message $\hat{\varkappa} = K\beta$ to the society. The decoding operation X made by the social strata produces the result

$$X\hat{\varkappa} = X(X^T X)^{-1} X^T \beta$$

which have smallest mean square errors given by the covariance matrix $\text{cov}(\beta - X\hat{\varkappa}, \beta - X\hat{\varkappa})$ given in (5).

Solution. In more general nonlinear version $\beta_i \in \mathbb{R}^m$, $\mathbb{R}^d \ni \varkappa \mapsto f_i(\varkappa) \in \mathbb{R}^m$, and the above problem (again without hermeneutics constrains), can be state in the form

$$\min \left\{ \sum_{i=1}^n p_i \|\beta_i - f_i(\varkappa)\|^2 ; \varkappa \in \mathbb{R}^d \right\}. \tag{6}$$

Set

$$\beta = \text{col}(\sqrt{p_1}\beta_1, \dots, \sqrt{p_n}\beta_n)$$

$$f = \begin{bmatrix} \sqrt{p_1}f_1 \\ \dots \\ \sqrt{p_n}f_n \end{bmatrix}.$$

Then, the necessary condition of optimality of $\hat{\varkappa}$, (the first derivative equals zero) gives

$$J^T f(\hat{\varkappa}) [\beta - f(\hat{\varkappa})] = 0 \tag{7}$$

where

$$Jf(\varkappa) = \left(\frac{\partial f_i(\varkappa)}{\partial \varkappa_j} \right)$$

is the Jacobian of $f(\varkappa)$. Thus, the necessary condition shows that for the best message the orthogonality conditions

$$(Jf(\hat{\varkappa}))_i \perp \hat{\varepsilon}$$

$$\hat{\varepsilon} \equiv [\beta - f(\hat{\varkappa})]$$

hold. In order to understand this conditions, first note that the Jacobi matrix is a measure of decoding sensitivity with respect to the infinitesimal changes of messages and that an efficient politician can, and even should be aware of this measure. And second, the product

$$J^T f(\varkappa) [\beta - f(\varkappa)]$$

is a sequence of a sum with weight given in the row of $J^T f(\varkappa)$. The weights are multiplied by coordinates of the difference $\beta - f(\varkappa)$. The orthogonality conditions say that this sequence must be $(0, \dots, 0)$ for the optimal message. In other words **All under- and over-interpretation in reconstructing intentions should be annihilated (neutralized) if they are weighted by the sensitivities of decoding operations.**

Energetic analogy. If a system of force fields is represented by the columns $(Jf(\widehat{\varkappa}))_i$ of the Jacobi matrix $Jf(\varkappa)$, and the difference $\beta - f(\varkappa)$ is a shift of an unit mass (or an unit charge), then our necessary condition (7) correspond to the theorem in classical mechanics; the mechanical works (efforts) of force fields are all equal to zero, if the shift is in the direction orthogonal to the all field lines.

A lie. Finally, we should mention an extreme (in a sense) application of the Shannon-Wiener information theory. This is connected with a phenomenon known as a *lie*. It exists in an interpersonal space, hence in a public space as well. Without going into the details about its essence and nature, we restrict ourselves here to the cybernetic perspective, a specially to the question; what the IT can offer to a liar? Assume, that the liar's goal is to hide his true intentions β and in the result, he is going to create a message \varkappa , which, after decoding has the form $\widehat{\beta}$. In the linear IT, we have

$$\widehat{\beta} - \beta = (X^T X)^{-1} X^T \varepsilon. \quad (8)$$

Thus, under the energy constrains $\|\varepsilon\| \leq a$, $a > 0$, the maximum (in the mean square sense) of intentions hiding is obtained by solving the problem

$$\max \left\{ \left\| (X^T X)^{-1} X^T \varepsilon \right\|^2; \|\varepsilon\| \leq a \right\} \quad (9)$$

and next, by creating the message

$$\varkappa^* = X\beta + \varepsilon^*,$$

where ε^* is the solution of (9). Indeed, the receiver obtains the message \varkappa^* , and after decoding he gets

$$\widehat{\beta} = (X^T X)^{-1} X^T \varkappa^* = \beta + (X^T X)^{-1} X^T \varepsilon^*.$$

Since ε^* solves (9), hence according to (8), the difference $\widehat{\beta} - \beta$ is square norm maximal.

4. Examples

Sometimes we hear the politicians' statements which openly violates our logic. For instance, "The Head of the Central Anti-Corruption Bureau (CBA) is suspected of having committed a crime of revealing a state secret by informing the President of the Republic of Poland, the Prime Minister and the Speakers of the Sejm and the Senate about the materials collected by the CBA concerning, so called, gambling affair, which suggest the possibility of legalization of the bill that will have negative effects on the state's budget". Such messages force us to think because it cannot be excluded that they have been given by the people who think and know what and why they say. On the one hand, the Head of the CBA

revealing the materials to the most important officials of the state has prevented the loss in the State Treasury and shown the concern about the public interests. On the other hand, he is said to have abused his power and have broken the law by revealing the materials. Either we recognize the primacy of the public interest over the regulations of the law or the other way round. What is more, the regulations of the law here block the access to vital information even in the case of the most important officials of the state which seems to be ridiculous and threaten the state's security. It seems that the only possible explanation to this confusion (according to the theory presented in the article) is to read the intention as follows: If my statement violates your logic you are a member of the stratum little in number and your opinion does not translate into the popularity I need. I think that the majority of the people I address has different logic than you. I appeal to their logic which accepts the primacy of the dogmas of law over the public interest. And even if there is no such primacy we should encourage such a point of view.

It seems that politicians are aware of the possibility of creating the messages that are not coherent. Some of them admit it with disarming frankness (often by means of such a message). Example: an important politician (also businessman and ethicist) of the ruling party commenting on the exclusion of the opposition MP's from the Investigation Commission admits that it was "essentially justified but spoilt the image". The obvious intention of the message is the attempt to reject the accusations of being "a judge in one's own case". The citizens who are outraged by such a course of events will decode the message in such a way as presented above.

5. Feedback and "dual" control

The structure of political parties allows some important politicians (usually the leaders) to generate the messages using the voice of their soldiers. If the opinion polls show that the vast majority of the public does not accept a certain message it is possible to dissociate oneself from it, for instance by getting rid of a soldier. Such an alternative generates more possibilities for a politician. Firstly, he or she may create a set of messages which are coherent if considered separately and not coherent if viewed altogether. Secondly, he or she may examine the boundaries of social acceptance for certain political decisions without the risk of losing personal popularity. For instance, the Prime Minister commenting on the exclusion of the opposition MP's from the Investigation Commission saying that "he does not approve of it and would not do such a thing himself". The message was transmitted when it was obvious that the public does not accept the decision. Conscious use of opinion polls in political games has its counterpart in Wiener's cybernetics [6] when it is called feedback. "Dual control" (DC) appeared in classical automatics thanks to the works of Feldbaum [7]. Thirdly, DC makes it possible to examine the attitudes to certain political decisions in the society in a more subtle way than dividing it into traditional strata. In the modern systems theory such an activity is called "the identification of an object".

However, following the analogies between politics and cybernetics leads us to reveal the darker side of the coin. Intensive use of opinion polls in political games may lead to addiction. Addiction not to the very practice of using the polls (which is not dangerous itself) but the institution, usually the company that conducts the surveys. The latter enables the institution to manipulate which is more dangerous, especially when the politician is the leader of the party or the head of the government.

6. Conclusions

1. Thanks to the media and by means of them incoherent messages get to the citizens with the result that goes beyond the short-term political interests of politicians. The result is destructing language and the attribute of explicitness in interhuman communication. The former is a natural consequence of social evolutions and has been taking place continuously since the distant past whereas the latter seems to be the result of deliberate actions, anyway, not of the natural and spontaneous processes. Both processes are present in other fields of human activities, for instance, in the arts. However, in the case of art it is permitted and justified (cf. Gombrowicz [8]). A propos our theory, the writer writes in his Diary: "Communication by means of art is a funny misunderstanding. Prose mixed with poetry is not a mathematical formula – it is different in everyone's head. A lot indeed depends on the head" (cf. Gombrowicz [9]). It can be treated as the writer's commentary on our theory. Even if Gombrowicz writes in his Diary that there is no point in writing masterpieces that no one is going to read and that the real art is to make people read your works, it is just a coy statement opting for the marketing of art and it is limited only to art. It seems that a short-term political

interest of a certain politician does not justify an abolition of such limitation.

2. The idea of treating the message creation problem as the inverse to the classical transmission problem appearing in the information theory of Shannon and Wiener, seems to be quite general, and not restricted to Political Sciences only. For example, it could be used in the marketing generally, i.e., in promotions, advertising, etc.

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