Shot Length: Random or Rigid, Choice or Chance?
An Analysis of Lev Kulešov's *Po zakonu* [By the Law]

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Im vorliegenden Beitrag wird die Annahme, dass die „Sprache' des Films nicht einfach mit den Kategorien der natürlichen „Sprache' zu erfassen ist, neu beleuchtet. Es wird die Ansicht vertreten, dass das Scheitern entsprechender Ansätze sich durch die im Kontext strukturalistischer Konzepte fokussierte Suche nach analogen (bzw. isologen) Einheiten und Relationen zwischen diesen erklären lässt, einhergehend mit fehlender Ausrichtung auf die zugrunde liegenden Prozesse.

Die Möglichkeit der Untersuchung dieser Prozesse wird am Beispiel der Einstellungslängen und deren Häufigkeiten in Lev Kulešov's Film *По закону* [Nach dem Gesetz] aus dem Jahre 1926 aufgezeigt. Abgesehen von der Art der direkte Abfolge von Einstellungen verschiedener Längen weisen diese unterschiedliche Häufigkeiten auf, die in einer spezifischen Häufigkeitsverteilung als Ergebnis des Generierungsprozesses resultieren. Im Rahmen einer synergetischen Theorie von Sprache und Kommunikation werden nicht nur die Elemente eines gegebenen Zeichensystems in ihren strukturellen Relationen untersucht, sondern darüber hinaus werden funktionelle und Verwendungsaspekte integriert, resultierend in einem dynamischen Prozess der Selbstregulation.

Zur theoretischen Modellierung dieser Verteilung wird im Beitrag ein diskretes Modell, die Zipf-Alekseev-Verteilung, sowie die Zipf-Alekseev-Funktion als deren stetiges Analogon diskutiert. Vor dem Hintergrund dieser Befunde lassen sich nicht nur Regularitäten der Filmkonstruktion beschreiben, sondern auch Grundprinzipien von Kommunikationsprozessen erfassen, die den Film auf einer anderen als bisher ins Auge gefassten Ebene u.a. auch mit der natürlichen Sprache vergleichbar macht.

1 Introduction: Film 'Language' = Film and Language?

The idea that film is structured like language, or rather, like *a* language, is pervasive in the history of film studies (cf. Gaut 2011: 310). In fact, this assumption refers back to reflections on this medium from the earliest days of its existence; it has been a constant and reoccurring topic and point of reference in extensive discussions and, though with varying focal points, in theoretical concepts of the first half of the 20th century.

A major contribution to this discussion has been made by Russian film directors and theoreticians, such as Lev Kulešov, Vsevolod Pudovkin, or Sergej Ejzenštejn, to name but a few. Kulešov (1929), for example, compared the individual shots, or shot signs, to letters (cf. Levaco 1974:

80) or to Chinese ideograms and their combination, i.e. montage, to phrases (cf. ibid., 91). Similar ideas can be found in Pudovkin's (1928: 100) writings, who equated shots with words, and their succession in sequences to phrases. Later, Sergej Ejzenštejn, a former student of Kulešov's, elaborated on these ideas, focusing on the written form of language, in general, and on Japanese ideograms, specifically. He too, propagated the idea of an analogy between words and shots, on the one hand, and between the sentence and montage phrase, on the other, as for example in his 1944 treatise *Dickens, Griffith, and Film Today* (*Дикенс, Гриффит, и мы*).

Despite some temporal delay, such ideas fell on fertile ground in the 1960s and 1970s, in the structuralist discussions concentrating on possibly existing homologies, or even isomorphies, between the codes of language and those of film. In fact, the extension of these ideas led to the reflections not only on the semiotics of film, but on semiotics, in general. A crucial question of that time was, whether film language is structured in the same way as verbal language, implying that semiotic products in both (or even further) media – that is, cinematic 'utterances' or 'texts' – share some common structural features. Alternative views focused less on the idea of common structural features, inherent to language or film, and more on the meta-level of analysis by raising the question, if both sign systems can be analyzed by way of identical means and methods. This, however, gave rise to the objection that under this condition only those structures are likely to be detected, or considered to be relevant, which are (or can be) seen in analogy to language.

These issues have been sufficiently discussed under terms such as 'logocentrism', 'ontological structuralism', and related terms and concepts, and this discussion needs not be taken up here once again. Neither is this the place to discuss at length all comparisons ever made between language, film and other media and semiotic systems (cf. Nöth 2000: 500ff.). In any case, one can summarizingly state that the search for a common basis between film, language, and eventually other media, as well as between film theory, linguistics, and, partly as a methodological extension of the latter, semiotics, has permanently persisted and regularly been – implicitly or explicitly – related to the search for the "language" of the film (cf. Klöpfer 2003:3189).

As a matter of fact, it is genuinely a question of abstraction, i.e. of the degree of abstraction, what kind of homologies can be found between language, film, and other semiotic systems, as soon as the problem outlined is primarily seen from a meta-semiotic point of view. Ultimately, this seems to be the reason why even scholars like Metz, having a rather critical position as to naïve comparisons between film language and specific linguistic units, could not abstain from using terms and concepts like

'code' vs. 'system', 'paradigmatic' vs. 'syntagmatic relations', 'cinematographic language' or 'filmic writing'. Specifically arguing against the equalizing treatment of shot and word, Metz explicitly refused to accept the analogy between a shot and a sentence. Favoring the notion of a shot as a complex utterance of indefinite length, Metz (1972: 160) termed the combination of two or more shots a 'syntagm', and started to develop a whole variety of different kinds of syntagms.

Quite characteristically, contemporary approaches would indeed favor notions such as 'syntagm' or 'syntax'; but at the same time, they would reject (too narrow) comparisons to linguistic syntax or grammar. Monaco (1981), for example, explicitly stated that film has no grammar; yet, he admitted that it is possible to identify "some vaguely defined rules of usage in cinematic language", which are ordered by the film's syntax (sic!), i.e., its systemic organization. In this context Monaco emphasized the idea of a film's syntax being the result of its usage, not its determinant; for him, there is nothing preordained about film syntax – rather, the syntax of a film is an organic development, descriptive rather than prescriptive. Similar ideas had been previously discussed in Lotman's 1973 book on *Problems of Film Aesthetics*, particularly the chapter on "Elements and Levels of Film Language."

In the last decades, such syntax-oriented approaches – which had not only shaped structuralist semiotic approaches of the 1970s, but already the earlier discussions, which had been closely related to the idea of montage theory in the domain of film – have, more or less, lost their prominence in the field of film studies and play but a minor role today. Instead, attention has increasingly shifted towards pragma-semiotic and cognitive-psychological aspects (cf. Kuchenbuch 2005: 15); thus, in one way or another, favoring the semantic and pragmatic dimensions of semiosis.

One of the reasons for this development, i.e. for the failure to find adequate syntactic descriptions, has to be seen, of course, in the fact that the search for analogies between film and language became increasingly abandoned after the 1970s, because the search for formal structures did not yield satisfying results (cf. Wulff 1999: 290), which might have convincingly proven the existence of the assumed isologies.

2 In search of a general model

From today's point of view, we have different options at our disposal to eventually explain the overall failure outlined. Apart from the possibility that object language and meta-language have not always been kept sufficiently apart – i.e. the search for analogical structures and units in language and film, on the one hand, and approaches or procedures to theo-

retically describe them, on the other – two options seem to be most plausible to come into play:

1. the linguistic model of 'language', which has been taken as the basis of analysis of film too, has been too poor to cover relevant structures (cf. Koch 1971);
2. Shaped by the structuralist approaches of the time, research has been too much influenced and, in fact, misguided, by the search of analogical units, and not processes.

Both options are not mutually exclusive, of course; after all, concentration on structure and neglect of processes results in a model too poor to grasp analogies on a deeper, more abstract level than they have been previously looked for. From linguistics we know, since Saussurian times, that there are no positive facts in language. Ultimately, analogical assumptions hold true for any science, and at the beginning of any scientific process must stand a definition of the object under study. Quite logically, the dictum holds true for filmic units, too. But what does this mean concretely? Let us, by way of an example, briefly discuss the consequences of this dictum with regard to the word, which has been used for comparisons with the filmic unit 'shot'.

2.1 In search of a unit

A word may be, for convenience's sake, orthographically defined as everything written between two blanks. Irrespective of the fact that such a definition gives a primate to written as compared to spoken language, it would lead to the need to accept zero-syllable words in languages like Russian, where prepositions like 'к' [to], 'с' [with], 'в' [in] have no vowel; and since vowels are the basic constituents of syllables, and syllables of words, our assumption would result in zero-syllable words, or if we define a word as consisting of syllables, of non-words. As a consequence, such prepositions have been treated like clitical forms, and they have been added to the subsequent or to the preceding word, in the first case like proclitica, in the second like enclitica. At closer sight, however, this procedure includes a shift, or rather a combination, of oral and written criteria, of graphemic and phonemic components in the definition of word. Given this fact, it might be more consequent to base a word definition on phonological criteria only, as is the case with so-called 'acoustic words' (alternatively also termed 'phonological words', or 'stress groups'), where a word is said to consist of and to cover all elements under one common accent. Three approaches, three definitions, and not all of them adequate for all languages equally.

Let us leave the results as it is, here. There is no need in the given context to make any decision; let it suffice to say that any comparison between word and shot and, in the next step, between word length and shot length, is doomed to fail, unless it is preceded by detailed theoretical discussions of phenomena like the ones mentioned. And it should have become obvious that word length differs, or course, according to the three definitions mentioned. And if we intend to study the frequency with which word lengths appear, be that in a running text or on the basis of dictionary material (what will in turn heavily affect the result), we are very likely to arrive at different results. And we have not even touched the problem, in which measurement units we intend to measure word length: in the number of letters per word, the number of syllables or morphemes per word, or in the number of milliseconds it takes to pronounce the word?

Once more, there is not a correct or wrong answer to these questions, neither with regard to the definition of a word, nor to the choice of adequate measurement units, nor to related questions of definition. Rather, answers depend on the fact if there is a theory, with respect to which decisions can be made, from which hypotheses can be derived, which can be empirically tested, and which either corroborate our assumptions or have to be rejected.

2.2 In search of processes

In linguistics or, more specifically, in the field of quantitative linguistics[1], such a theory has been developed over the last decades. There is no need to go into details here, specifically since the relevant aspects are summarizingly described elsewhere (cf. Wimmer and Altmann 2005, 2006).

With regard to frequency distributions, a basic assumption in the framework of this theory is that neighboring classes P_x and P_{x-1} (e.g., one 1-syllable and 2-syllable words) are not isolated from each other, but stand in a specific relation to each other, that is $P_x \sim P_{x-1}$. Moreover, it is

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[1] Quantitative linguistics distinguishes itself from traditional linguistic approaches by its ontological view upon language, seeing it not only as a system of elements and functions, but also studying its processes and dynamics, governed by laws and regularities. These laws can be expressed by mathematical formulas just like the laws of nature. The laws we are concerned with here are stochastic and not deterministic, i.e. those laws model probabilities of the occurrence of certain events or conditions. There will always be counterexamples that might seem to contradict them, but those counterexamples are again part of the statistical model and are themselves quantitatively determinable (cf. Köhler 2005).

assumed that this relation is not constant, but has the form of a function $g(x)$ which regulates the frequency relations, so that $P_x = g(x) P_{x-1}$. Mathematically speaking, we thus obtain

(1)
$$\frac{\Delta P_{x-1}}{P_{x-1}} = g(x)$$

where Δ is the difference equator. The solution of (1) yields the recurrence equation

(2)
$$P_x = [1 + g(x)] P_{x-1}.$$

As empirical studies of the last decades have shown, the majority of distribution models relevant for linguistics can be derived from the so-called Wimmer-Altmann family, given as

(3)
$$P_x = \left(1 + a_0 + \frac{a_1}{x+b_1} + \frac{a_2}{x+b_2} + \ldots\right) P_{x-1}.$$

In other words, frequency distributions like the well-known Poisson distribution, the binomial distribution, the negative binomial distribution, and many others, can be shown to be special cases of (3). All of these distributions, albeit usually in modified forms, have repeatedly been shown to be relevant for the modeling of word length frequencies in different languages (cf. Grzybek 2006). The important thing about this is that research is not characterized by the ambition to find one common, eventually universal model for the object under study. The goal is to find a general mechanism, from which, under particular circumstances which represent boundary conditions in the theory of science, generally valid laws can be derived.

It may be emphasized that the mechanism[2] outlined does not, of course, concern only word length phenomena, but has been successfully applied to almost any kind of linguistic analysis. It should also be emphasized that from the very same approach, not only discrete models can be derived, but that the situation is analogical for continuous models, from which specific curves can be derived; in this case, the very same assumptions hold true, and one obtains

(4)
$$\frac{dy}{y-d} = g(x)\,dx$$

[2] From this perspective, a frequency distribution can be interpreted, for example, as the outcome, or product, of a generating process; in fact, it is quite common in the field of statistics, to interpret distribution models in terms of birth and death processes.

from which again the majority of continuous functions used in linguistics can be derived. Given the fact, that ultimately it is not reality which is either continuous or discrete, but our conception of it, and taking into account that on the basis of the model outlined above, discrete models can easily be transformed into continuous ones and vice versa, it seems that quite some discussions as to this issue in the field of film theory turn out to be obsolete from a modern point of view.

It seems worthwhile to take up the discussion about analogical processes in film and language again from such a contemporary perspective. In fact, such an attempt shall be made in the subsequent analyses with regard to shot length. One should not expect, as a result, that identical frequency models will turn out to be relevant for word length and shot length distributions; one should not even expect that the same models will be encountered in the field of language and film analysis. But it seems more than likely that we will be concerned with models which can be derived from (3), the more since its 'philosophical' basis has repeatedly been explained in terms of the two antagonistic Zipfian forces of unification and diversification, which means, in the end, between contradictory processes of producers' and recipients' economies of effort (cf. Altmann 2005). With this in mind, let us turn to some general and elementary ruminations on shot length. At first glance it may seem that the length of individual shots in a film is fully in the control of those individuals who direct and edit the film. In fact, this idea – which turns out to be naïve from a modern point of view – has repeatedly been brought forth in the history of film theory. Here is not the place to go into details: it would definitely go beyond the scope of this article to give a full account of what filmmakers, theoreticians and critics wrote about shot length in almost a century's time. Therefore we will, by way of an example, focus on the ideas brought into discussion by Russian film theorist and director Lev Kulešov (1899–1970).

3 The case of Kulešov

3.1 Is there always choice?

Kulešov was one of the first who would theoretically reflect the importance of shot length in film; he was not only a director of feature films and professor at the Moscow All-Union Institute of Cinematography, but, according to Levaco (1974:1), also "the first aesthetic theorist of the cinema". Among Kulešov's disciples were famous directors like Sergej Ejzenštejn, Vsevolod Pudovkin, Boris Barnet or Michail Kalatozov. Kulešov worked together with distinguished literary scholars of his time, like

the formalists Viktor Šklovskij or Osip Brik, who co-authored some of his screenplays (ibid., 6). Some of Kulešov's theoretical concepts, which are still known today, are the *Kulešov effect* and the *creative geography*.

Besides his theoretical thoughts about the basic components of film, Kulešov was interested in the question of whether there were any general regularities common in the composition, the cutting and the movement of the actors. Kulešov started directing in 1917, i.e. during the period of silent films, and he continued to make films after the transition to sound film in the late 1920s and early 1930s. In his early days of directing his editing style was strongly influenced by American cinema, especially by D.W. Griffith who revolutionized cinema using fast cutting, parallel lines of action and numerous close ups (cf. Kulešov 1929).

Kulešov's first theoretical articles on film go back to the late 1910s. One of his major monographs was the 1941 text book *Osnovy kino režissury* [Fundamentals of Film Direction], the first text book on film direction in the Soviet Union (cf. Kulešov 1941: 3). This book covers all basic decision making processes, from the very start of choosing a suitable topic to the final cut. In it, Kulešov defines shot length as the unadulterated continuous action on film (ibid., 65).

Kulešov had very precise ideas and gave practical advice as to how long shots ought to be. According to him, three main factors should influence the choice of individual shot lengths:

a. the theme of the film or the respective scene,
b. the ease of perception by the viewer, and
c. the rhythm.

As to the relation between shot length and content (a), Kulešov was not very detailed: in any case, all shots of a scene should be devoid of everything unnecessary, or superfluous, and they should be brought into such a logical order that helps to unfold the story (1941: 23f.). As a result, each shot has to contribute either to the film as a whole, or to the scene in which it is embedded – in other words, the story told should be made easily understood. What, thus, comes into play, is, at least implicitly, a viewer's perspective. This becomes even more evident with regards to points (b) and (c). In his emphasis on the importance of the ease of perception (b), Kulešov (1941: 275) refers, by way of an example, to the two pictures reproduced below (Figures 1a and 1b).
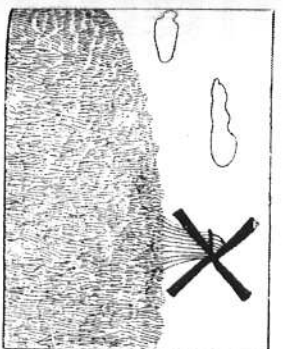

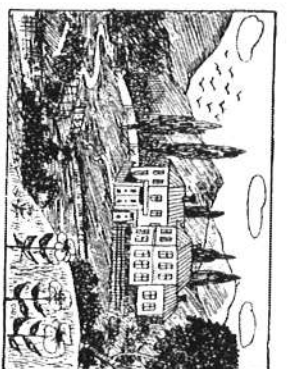Fig. 1a: Fast comprehensible picture

Fig. 1b: Picture which takes longer to comprehend

Whereas, according to Kulešov, the first picture is easily and rapidly comprehensible, the second takes much longer, because of its numerous details. Thus, with regard to the viewer's ease of perception, Figure 1a therefore needs less time to be perceived, as compared to Figure 1b. In other words, the length of a shot does not only depend upon the purpose [zadača] of a shot, or its function, but also on the perceptual difficulty (ibid., 275). One of Kulešov's practical advices, for instance, is that motionless objects should be shown at least half a second (cf. ibid., 15); another practical advice is that students ought to plan the shot length beforehand as precisely as possible (ibid., 65). According to his experience, it is common for directors to underestimate the length of the shots by about 20%; therefore, Kulešov advised his students to add a fifth more time to their initial estimate (ibid., 122). As to the third criterion (c), the rhythm of the given scene (cf. ibid., 275), Kulešov, emphasizing the aim of editing, points out that the viewer should be able to watch the action in the best possible way at an appropriate rhythm (cf. ibid., 307).

What can be seen from these ruminations and statements, is quite characteristic not only for Kulešov, but for the assumption that shot length is a variable controlled by the producer, in general: the perceiver's position is always, at least implicitly, contained, i.e., the perception processes involved are part of the concept. At closer sight, this is nothing surprising: not only an everyday speaker, but even the most extreme avant-garde wants to be perceived, appreciated, 'understood' on whatever level of abstraction, and this is impossible without taking into account the recipient's perspective, in one way or another. After all, it is just here where the above-mentioned antagonistic forces of producer and recipient come into play, resulting in a 'text', based on a 'language' (both terms used in their broad, semiotic meanings here), which satisfies both needs, and which, in fulfilling this function (or rather, these functions), turns out to be in a constant process of dynamic balancing.

This circumstance has given rise to the idea that shot length is not, or not only, or maybe even not so much, a matter of *choice*, than of chance, here being understood in statistical terms, to denote random processes, by which, in turn, stochastic processes involving random variables are meant. The idea that shot lengths are governed by chance is less often found in film studies, with the exception of a few scientists interested in statistical style analysis.

Since the 1960s, the idea has been repeatedly suggested by various scholars[3] that the frequency distribution of shot length is no chaotic process, but ruled by specific regularities. A number of attempts have been undertaken to model these frequencies, be it by discrete frequency functions, or, more often than not, by continuous functions and curves. As to discrete distribution models, the Poisson distribution has been introduced into the discussion[4]; and as to continuous models, the lognormal distribution has been favored[5]. The lognormal distribution describes the distribution of a random variable X when the logarithm of this variable, i.e. $\ln(X)$, follows a normal distribution.

Attempts to explain why a certain function or distribution might be typical for shot length distributions have been of more or less ad hoc type. A profound theoretical discussion has not arisen so far; no strive for integration into a larger theory is discernible. In other words: the thought has not occurred yet that shot length might be governed by the same or similar fundamental laws or regularities which explain a multitude of phenomena in the cultural and natural world.

If at all, then, discussions into this direction tend to have arisen mainly around the lognormal distribution[6] – absurdly enough, because it is just the lognormal distribution, based on the normal distribution, which

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3 Cf., among others: Birett (1962, 1972, 1975, 1978, 1988, 1993, 1994), Salt (1974, 1992, 2006, 2010, 2011)), or Redfern (2009, 2010, 2011).
4 Cf. Birett (1972, 1988).
5 Cf. Birett (1975, 1978, 1988, 1993, 1994), Salt (1974, 1992, 2006, 2010, 2011).
6 Birett (1975, 1978, 1988, 1993, 1994), for example, interprets the lognormal distribution as standing in relation to the human perception of time, assuming that the duration or intervals of time are not experienced linearly, but perceived according to a lognormal function. As compared to this, for Salt (2006: 391) the lognormal distribution results "when the quantity under consideration [...] is determined as a result of the probabilities associated with a large number of independent causative factors being multiplied together", independent causes for him being associated with those individuals who have an influence on the film, starting from the script-writer, over the movements of actors, and the lengths of the dialogues, and ending with the editor (ibid, 391).

cannot explain the asymmetric balancing between the two Zipfian forces; characteristically enough, the lognormal distribution, which has been discussed in linguistics as well, as a model for word length frequencies, in the 1950s and 1960s, does not play any role here, any more. Furthermore, it should be noted that more often than not, no statistical tests have been undertaken to test the models applied for their goodness of fit[7]; the majority of conclusions have been drawn on the basis of graphical impressions, only.

3.3 *Towards a concrete model*

Given this situation, we suggest to tackle the question anew. Our research interest is not, to be sure, the search for direct parallels between shot length and word length. Rather, with regard to the theoretical framework outlined above, the crucial question may be phrased as follows: are features of film governed by laws comparable to those meanwhile known from the field of quantitative linguistics? Our assumption is that the elements of film, shot length being one of them, are subject to the same, or at least similar, laws and regularities which are also found in language and other semiotic systems.

The overall goal of our approach to film studies thus is to search for explanations of the nature of film, the mechanisms that govern it, the functions of its constituents, its development over time, etc., to find interrelations between the elements, and to integrate this knowledge into a larger context (cf. Köhler 2005: 7).

By way of an example, we will analyze one movie only here[8], Kulešov's most celebrated movie, the silent film *Po zakonu* (*By the Law* // *Dura Lex*) from 1926. The scenario of this movie is based on a story by Jack London, *The Unexpected* (1907), which was adapted to the cinema by Kulešov himself and by above-mentioned Russian formalist Viktor Šklovskij.

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7 So far, the largest sample to test the appropriateness of the lognormal distribution has been conducted by Redfern (2011). He tested 168 Hollywood films for their goodness of fit: 52 silent films, 66 films from the transition period from silent to sound (1929–1931), and 50 sound films from the early 1930s. The result of the study is that only 25% of the silent films are lognormally distributed, only 24% of the films from the transition period, and 20% of the sound films. In other words, for the majority of feature films, the assumption of being lognormally distributed turned out to be not justified (Redfern 2011).
8 This analysis is but a small part of a larger ongoing research project, in which 20th-century Russian films are systematically studied with regard to the questions outlined above.

The story takes place during the time of the Gold Rush on a shore of the river Yukon. Except for about the first fifth of the film, the story unfolds itself in a one-room cabin. At first, the cabin is shared by free gold prospectors. One of them, Michael Denning, initially found the place where gold can be prospected. Whereas the other four men mine the gold, Denning is treated like an inferior, having to wash the clothes and do other housework, while the others mock him. Having had enough of this situation, Denning decides to kill them and to take off with the gold. He succeeds in killing two men but the remaining couple feels obliged to perform a trial to sentence the murderer and couple, Edith and Hans Nelson, can overcome him and tie him up. The then to execute him. As opposed to the ending by Jack London, Denning not only dies on the tree, but returns as a ghost and curses the Nelsons.

Table 1 presents the shot length frequency distribution[9]; for the time being, we can concentrate on the columns containing the individual length classes (denoted by x), which are pooled to 1-second intervals, and the observed frequencies f_x with which they occur (the theoretical frequencies Np_x can be ignored here, for a moment).

x	f_x	Np_x	x	f_x	Np_x	x	f_x	Np_x
1	92	91.96	11	6	12.90	21	2	1.56	31	0	0.33
2	200	195.07	12	11	10.05	22	2	1.31	32	0	0.29
3	154	148.59	13	9	7.92	23	1	1.11	33	0	0.25
4	98	106.33	14	4	6.29	24	2	0.94	34	1	0.22
5	76	75.65	15	10	5.05	25	0	0.80	35	0	0.19
6	49	54.35	16	3	4.08	26	0	0.68	36	0	0.17
7	50	39.61	17	1	3.33	27	3	0.59	37	1	0.15
8	25	29.30	18	2	2.73	28	0	0.51			
9	25	22.00	19	1	2.25	29	0	0.44			
10	18	16.74	20	0	1.87	30	0	0.38			

The data are graphically presented in form of a bar chart in Figure 2: on the horizontal x-axis, we have the length intervals (in seconds), on the vertical y-axis the corresponding frequencies.
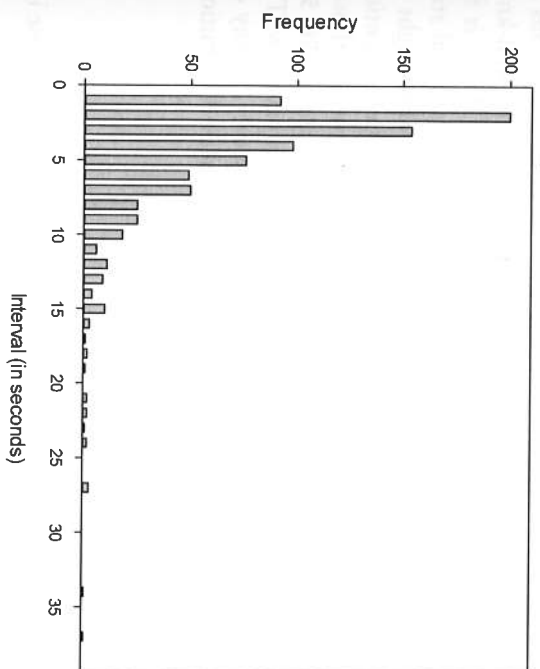

Figure 2: Empirical shot length frequency distribution in Lev Kulešov's *Po zakonu* (1926)

The overall question is, whether the observed shot lengths follow some underlying regularity, and how the result can, by way of an explanation, be integrated into the theoretical principles and concepts discussed above. In the context given, we will not delve into further details here as to the problem of continuous functions vs. discrete distributions – this discussion will have to be pursued elsewhere. Generally speaking, one can say that discrete distributions are more 'demanding', since here, as opposed to functions, it is necessary that the sum of all probabilities sums up to 1; therefore, functions usually yield seemingly better results (and it is likely that this is the reason why they are favored in many a discipline). In any case, by way of a first approximation, we will offer a solution which includes both a curve and a distribution model, both of which, to our mind, turn out to be adequate models, the more since they correspond to one and the same theoretical idea.

With regard to a discrete frequency model, our analysis of the data reveals that the right truncated modified Zipf-Alekseev distribution turns out to be an adequate model. The Zipf-Alekseev distribution, given by

$$P_x = \frac{x^{-(a+b\ln x)}}{T}, \qquad x = 1, 2, 3, \ldots \qquad T = \sum_{j=1}^{\infty} j^{-(a+b\ln j)},$$ (5a)

9 The shot length data are taken from the database of CineMetrics (www.cinemetrics.lv), a platform for the study of film. The data were provided by Eksta (2008) and have been pooled to intervals of 1 second.

is a generalization of the Zipf distribution (also known, among others, as zeta distribution) for $b = 0$. Interestingly enough, there are various suggestions available to theoretically derive this model from well-known principles. One of them is Hammer's (1990) attempt to derive it from psychophysical models describing the relation between a physical stimulus and the human reaction to it (Weber-Fechner law) – what might turn out to be a convincing explanative alternative of the above-mentioned logarithmic processes coming into play – ; other attempts are those by Hřebíček (1997: 42f., 2000: 14f.) and Hřebíček and Altmann (1996: 56f.), who offer interpretations referring to the Menzerath-Altmann law. These theoretical perspectives will be pursued elsewhere, however. In any case, for our purposes, it is preferable to use the Zipf-Alekseev distribution in its right truncated form

(5b) $$P_x = \frac{x^{-(a+b\ln x)}}{T} \qquad x = 1,2,3,...n \qquad T = \sum_{j=1}^{n} j^{-(a+b\ln j)}$$

which, as opposed to (5a), has a finite domain. Additionally, we use its 1-modified version of the right-truncated form

(5c) $$P_x = \begin{cases} 1-\alpha & x=1 \\ \dfrac{\alpha x^{-(a+b\ln x)}}{T} & x=2,3,4,...n \end{cases} \qquad T = \sum_{j=2}^{n} j^{-(a+b\ln j)}.$$

It includes a 'local' modification in form of the separate modeling of the first class, which comprises all very short shots up to one second.[10]

With parameter values for $\alpha = 0.89$, $a = -0.60$, and $b = 0.71$, we obtain the theoretical values NP_x given in Table 1 above, which are graphically represented in Figure 3, in which the light grey bars represent the observed frequencies f_x (as in Figure 2), and the dark ones the theoretical frequencies NP_x, which are given above in Table 1, the x-axis representing the corresponding intervals.
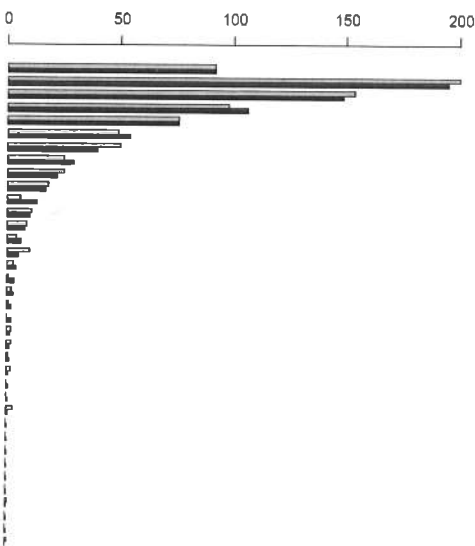

Figure 3: Fitting results for the right-truncated modified Zipf-Alekseev distribution

The optical impression indicates a very good fit. This is confirmed by the chi square test statistics, which proves the model to be adequate (with $X^2 = 20.34$, d.f. $= 22$, $P = 0.57$). This result is also confirmed by using the continuous Zipf-Alekseev function

(6) $$f(x) = Cx^{-(a+b\ln x)}.$$

For continuous functions, the goodness of fit is tested by reference to the determination coefficient R^2, which in our case, with parameter values for $a = 1.66$, $b = -1.14$, and $C = 100.79$, yields an excellent fitting result of $R^2 = 0.98$; the result is graphically presented in Figure 4. Setting C to the first frequency class (f_1), what in our case corresponds to $C = f_1 = 92$ (cf. the data given in Table 1), and thus reducing the number of parameters from three (a, b, C) to two (a, b), leads to an identically good result ($R^2 = 0.98$), with slightly different parameter values $a = 1.82$ and $b = -1.20$.

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10 An explanation for the need of this special treatment of the first class can only be offered on the basis of more comprehensive analyses, which will show whether such very short shots are generally characteristic for all movies in our data base, or if they concern particular films, only. Then, it will also be possible to study and eventually interpret particular parameter behavior, and to see, if for a part (and if so, which) of the movies special cases will suffice.
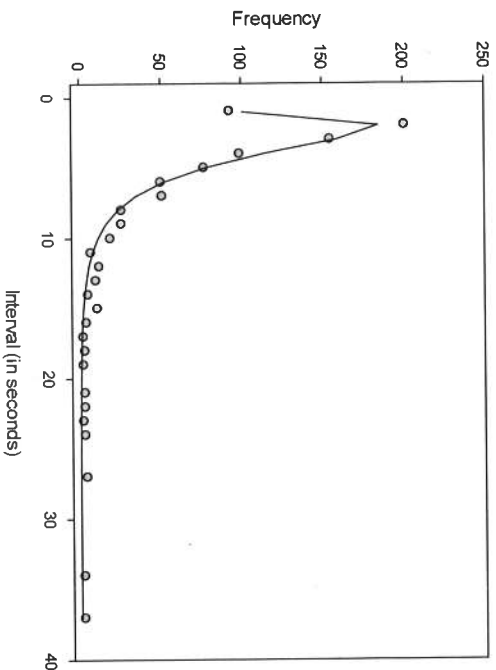
The present contribution concentrates on shot length in film, which repeatedly has been seen in analogy to linguistic units, mainly the word. However, previous comparisons between the sign systems of language and film, based on formal features or structuralist assumptions with an emphasis on constituent elements, functions, and combinatory rules of combinations, were doomed to failure since they fell back on restrictive models of language, largely ignoring the study of involved processes. Choosing a syntagmatic approach, the focus is on regularities of shot length frequencies which are being understood as the result of a specific generating process to be modeled. With regard to earlier views which have favored the concept of a more or less producer-controlled choice process, it can be shown that in such concepts the recipients' perspective (i.e., the reception process), has always been implied, too, be that explicitly or implicitly. With this in mind, shot length frequencies can be interpreted as the result of two forces which, in the field of quantitative linguistics, are known as the Zipfian forces of unification and diversification, related to (antagonistic) producers' and recipients' economy interests, and resulting in a process of dynamic balance of the sign system involved. Applying this concept to the realm of film analysis, it can be shown that shot lengths can, in fact, be interpreted in terms of stochastic processes.

4 Summary and conclusions

Figure 4: Fitting results for the Zipf-Alekseev function

By way of an example, the 1926 film *Po zakonu* (*By the Law*) by Russian film director and theoretician Lev Kulešov was analyzed. It was shown that the continuous Zipf-Alekseev function and its discrete counterpart, the Zipf-Alekseev distribution (in its right-truncated and 1-modified form), are suitable models for shot length frequencies. As compared to other models previously discussed in the realm of film theory, particularly the lognormal distribution, this model lends itself to convincing interpretations which have been offered in the field of quantitative linguistics. These findings give rise to the assumption that the distribution of shot lengths is ruled by a specific mechanism which can be assumed to exist in a variety of semiotic systems. Future studies will have to prove (or rather: test) the sustainability of this model, including the question of parameter interpretation, particularly taking into account further factors (to be understood as boundary conditions) coming into play, both internal and external, such as, e.g., genre specifics, sound, color, film studio, director, and others more.

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