The Standing Ovation Phenomenon:

Modeling different influences of the ritual with the use of the Bass Diffusion Model

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Introduction:

Whoever likes going to the theatre or the opera will have experienced the phenomenon of standing ovations before. In order to show their enthusiasm and appreciation of the performance, people stand up during the applause as a sign of respect. One might have even joined such a standing ovation out of the urge to reward the artists with more than just applause. However, if one has experienced standing ovations, one might also remember moments like these: After a few people stood up in groups, more and more people are joining until the whole audience stands and claps. Or even the opposite: The individual, deeply moved after an outstanding performance, wants to get up, but realizes that no one else does so and therefore remains seated in spite of his/her extraordinary appreciation for the play. Those situations imply that there is more to standing ovations than just a pure recognition of the performance. They must also involve forms of peer pressure. This leads to the attempt of examining standing ovations not as a ritual, but as a social phenomenon that depends on human interaction.

The relevance of this aspect becomes obvious when we put the phenomenon into a broader social and historical context: When recognizing the possibility of social influence and predicting the outcome of the audience's response, it appears possible to manipulate this response. This idea is not at all a new one. One famous example is probably the "Sportpalast speech" of Goebbels during the Second World War. It roused the impression of a huge mass of listeners representing the population of Germany, fanatically cheering for the announced 'total war', whereas in fact the audience was carefully selected beforehand to ensure a positive outcome and even applause was played through loudspeakers to reinforce the applause (Rothmeier, 2007). How to model the development of a standing ovation to show both appreciation and social influence, shall therefore be the central question of this paper. After a process of instantiation, it will be argued that the Bass Model is appropriate to illustrate standing ovations including both quality of the given performance and social influence given certain prerequisites, which will be later analysed in detail.

Analysis of standing ovations through instantiation

As mentioned above, the ‘success’ of a standing ovation depends very much both on the original appreciation of the given performance and the effect of interaction within the audience. However, this statement involves more than just one vague term and needs some clarification: Standing ovations can be defined as the standing up of individuals in the audience after a performance, which evokes the impression of, but not necessarily originates from an extraordinary appreciation of the performance. Its success can be therefore indicated by the portion of the audience (P) getting up over the time (t) the applause lasts.

Certain conditions have to be met in order to apply this definition to reality: Standing ovations can in this way only work within social networks which recognize the ritual as such, which is the case during events with classical character, such as operas and theatres. However, the development of a standing ovation over time and the probability of its total success (the whole audience gets up) are influenced by two variables: Quality (Q) and social interaction (S). The quality of the performance is a very subjective term and differs within the audience. However, it is more than just a personal judgement based on emotions, because it also depends on the suspense and presentation of the given act, especially of its ending. A play, which is for example very dramatic in the end would more likely to cause extreme responses than one with a falling suspense. One can therefore also determine Q as a variable that influences the whole crowd. This is necessary in order to apply the to model a bigger amount of people, as it is the purpose of this paper and not the individual reaction of each person itself.

The social interaction (S) among the audience can be defined as the variable that influences the probability of getting up based on the reactions of others. It depends on the intimacy of the setting, the relationship between different audience members and differs from occasion to occasion. It is important to note here that this social interaction only takes place over a very short time, i.e. the applause and is mostly based on non-verbal and indirect communication, which limits its scope, but does not reduce its importance.

In order to show the success of a standing ovation, one can model the frequencies of the audience (Y-axis) getting up over time (X-axis). A possible function could result in a sigmoid curve. This would indicate some hesitation in the beginning and a rapid change as soon as the first people start getting up, whereas in the end the curve flattens demonstrating that people who have not been convinced to join in despite a majority getting up, are very unlikely to get up after all.

These variables of both original and social influence on decision making are easily observed in other phenomena as well: Consumers, who are introduced to a new product may very well base their decision not only on the quality of the product, but also on the recommendations of former consumers (P. I. Bass, Berdan, & Eller, 2010). Whereas time and setting might differ from standing ovations, not only basic principles of quality and social interaction may be found, but also the result as a 'yes-or-no-decision' of buying or not buying, standing or not standing is similar. The development of buying consumers (standing people) can have a similar S-shape in a scatterplot. Having specified the general conditions of the phenomenon, it is now possible to generate a model, which computes an appropriate development depending on the given variables over time.

General model

At this point, the reference to the similar phenomenon of product adoption before proves useful because of the already existing model to illustrate and explain this phenomenon as developed by Frank Bass, an American marketing scientist. Based on empirical research, Bass (2004) developed a mathematical equation, which shows the bounded exponential growth of consumers buying a new product and has the graph of a S-shaped function. This model is part of the broad spectrum of diffusion models, which analyse how information or objects diffuse through a certain environment over time (Lave & March, 1993). As a result of the research and some "algebraic manipulation" (P. I. Bass et al., 2010), Bass came to the following equation:

$$F(t) = \frac{1 - e^{-(p+q)t}}{1 + \frac{q}{p} e^{-(p+q)t}}$$

(P. I. Bass et al., 2010)

This function consists of several parameters and variables, which are essential to show the portion of possible consumers (F), which have bought the new product at time (t) (P. I. Bass et al., 2010). The development of the graph is dependent on two parameters: *P*, which does not relate to the number of other consumers, and is therefore independent, it describes “the probability of initial purchase at time t=0” (Bass, 2004, p.4) called the “coefficient of innovation”(P. I. Bass et al., 2010). The other parameter *q*, called “coefficient of imitation” (P. I. Bass et al., 2010), affects the number of consumers at a time *t* proportionally to the number of former consumers, and therefore symbolizes social influence. The parameters *p* and *q* play a key role in the model. Their values were estimated in extensive observation of different products and it was examined, how their relationship affects the development of the adoptions over time (Lilien, Rangaswamy, & Van den Bulte, 2000).

If *p*=1, then the probability of a purchase right after the product has become available is 100%, and sales will go up rapidly. When *p*>*q*, the influence resulting from the innovation of the product is higher than the social influence and the number of customers will grow quickly (Lilien, Rangaswamy, & Bruyn, 2007). When *p*<*q,* it means the opposite, and the adoption of the product will take longer (Lilien et al., 2007). Since their estimation varies from product to product, predictions are limited to former research history in order to forecast the development of a new product.

Application

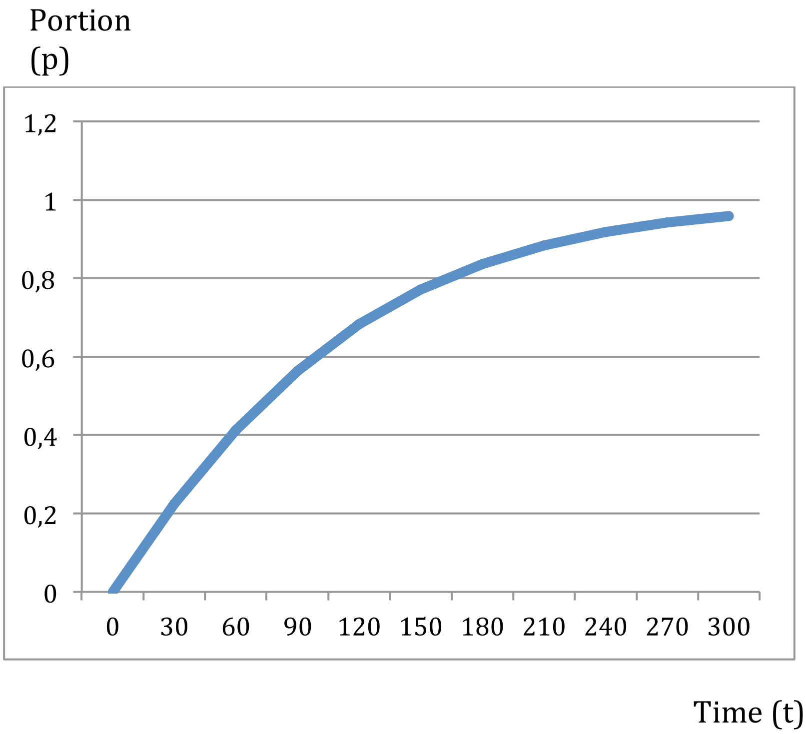
Despite the difficulty of estimating the values for *p* and *q*, the Bass model is very well suited to illustrate the development of a standing ovation over time. This is due to the fact that it involves the variables of quality (Q) and social interaction (S) as the parameters *p* and *q*. The initial, original response to the performance would be therefore described as *p*, with a value between 0 and 1, where values near 0 stand for a very low acceptance and higher values for a higher probability to get up immediately after curtain fall, i.e. a higher appreciation of the performance. The effect of social interaction, as described during the process of instantiation, would be expressed in values between 0 and 1 for the letter *q*, which indicates a high social dependence for higher values of *q*.
But before the effects of these parameters can be shown in detail, certain pre-conditions have to be met to apply the Bass Model to our phenomenon. These conditions are described by Lilien et al. (2007) as “key assumptions” (p.7) as follows:

1. M, the number of possible consumers is stable: The number of people in the audience does not change during the time of applause.
2. The decision is "binary" (p. 7): A member of the audience can either remain seated or stand up.
3. The parameter q must remain the same over time: It means that the social influence cannot change during the applause. If the dependency on each other altered over time, new values for q require new calculations.
4. "Everyone is in contact with everyone else" (p. 7): Every member of the audience must be able to be influenced by any other member. Through eye contact, listening or active motivation.
5. The former consumers only report positively about the product: The influence of others can only be in one direction: Promotion for the product. Therefore, the 'still sitting' members cannot receive the fact that others are still sitting as criticism, neither can standing people report a regret of their decision.
6. The development of the product adoption is not connected to other products: The applause only focuses on the given performance and must not, for example, increase because of another very popular performance with the same participants.
7. The consumers cannot buy the same product twice or return it: After a member of the audience has decided to stand up, s/he cannot change his opinion anymore and sit down again.

The statements in front of each colon are based on those described by Lilien et al.(2007). These assumptions already show some difficulties regarding the accuracy of the model in the case of standing ovations. They will be elaborated later in the text. Given the case that the conditions are met, the parameters p and q become important. In order to show their influence, two hypothetical examples are presented as a thought experiment. Due to missing empirical data, the values for the parameters are arbitrary, but estimated according to the given description. Furthermore, the graphs of both cases do not show the typical sigmoid function. This is, however, caused by the extract of the function. The given graphs only display a small window of the whole, indeed S-shaped function.

One could assume that values for p are higher, when the performance is well known and popular. There is a general fondness in the audience of the production and people are more likely to get up. A performance of Verdi's the famous opera *La Traviata* could lead to p=0.008 and q=0.004. The values seem to be low, but this is due to the scaling since time (t) is measured in seconds. The value for q is only the half of p. This is based on the assumption that this opera attracts a huge number of people and is played in large concert halls. Due to diversity of the audience, non-verbal motivation is difficult to transmit. A graph would then have the following form:

t in seconds	Portion (P)
0	0
30	0,224136358
60	0,412785586
90	0,564545852
120	0,682250232
150	0,77098004
180	0,83644341
210	0,883978127
240	0,918096668
270	0,942382422
300	0,959566809



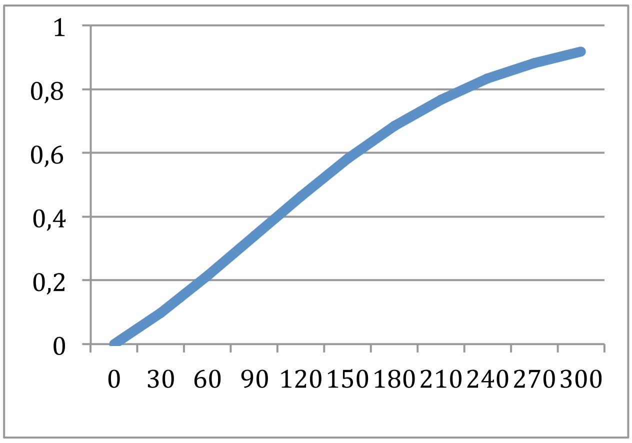
$$F(t) = \frac{1-e^{-(0.008+0.004)t}}{1+\frac{0.004}{0.008}e^{-(0.008+0.009)t}}$$

Given that the applause lasts for 3 minutes, already after 90 seconds, more than half of the audience would stand (see table, row 4: 90 -> ≈ 56%). This shows the immense effect of the character of the performance itself even with low social influence.

This, however, can change with new productions and unknown artists. The premiére of the piece *Fragment* (1968) by Pina Bausch might have looked completely different. *Fragment* was Bausch's first choreography of a new form of dance, the "Tanztheater". Despite her later success, Bausch's fame must have been modest by the time of this premiére. As a thought experiment, the parameters are again estimated based on assumptions and adapted to the scaling. Since the way of dancing and storytelling was new to the audience, p must have been small, in this case p=0.003. The audience, too, differed from the one of *La Traviata*. *Fragment* might have very well been performed in an intimate setting, and the spectators were mostly friends and family, who knew each other. Therefore, the social interaction would have been higher. You are more likely to stand up, when a person you know stands up and cheers euphorically. Since in the Bass Model the social interaction only transfers positive promotion, an individual values the opinion of a person s/he knows more than the one of a stranger. Furthermore, a small number of people may cause higher pressure on you to imitate your neighbours because it is less easy to hide in the mass. The parameter *q* is therefore estimated as *q*=0.01:

t in second	Portion (P)
0	0
30	0,09915793
60	0,21423643
90	0,3389599
120	0,464501908
150	0,581806158
180	0,684034325
210	0,767851592
240	0,833203187
270	0,882187474
300	0,917829354

Portion (P)



Time (t)

$$F(t) = \frac{1 - e^{-(0.003+0.01)t}}{1 + \frac{0.01}{0.003} e^{-(0.003+0.01)t}}$$

The rate of change in this graph is much lower, which can be seen in row 4: After 90 seconds, only a third of the members stand. Nevertheless, the high social interaction affects the development of the standing ovation almost to the same extent: Despite the low value for *p*, when the applause is over, more than 91% of the audience stands. To compare: La Traviata has a final value of ca. 96%.

As it can already seen in the term *q/p* in the equation, the original influences dominate the social influences. A possible social manipulation would therefore require bigger effort to exceed the original influence. Even though *p*, as the ‘original’ parameter, has a bigger influence, *q* can make crucial differences, too, when the value is high due to an intimate atmosphere or personal relationships.

Discussion of the suitability of the Bass Model

As shown in the two examples of applying the Bass Modell to possible cases, the comparison of standing ovations with product adaption appears to be a good strategy of modelling. It allows us to show the 'spread' of the idea of standing up based on both social interaction and quality of the play. However, the suitability can be questioned due to the missing empirical data, which means estimating the values for p and q becomes difficult. Until this model would be able to predict the development of a specific event, many comparable cases would have had to be studied including the individual relationship between the members of the audience. Strategies for social intervention and targeted influence might take even longer. Furthermore, the named key assumptions create difficulties when it comes to applying the model to empirical observation. Already the first assumption is questionable. Not every member of the audience will necessarily stay until the end. Some might want to leave during the applause. Furthermore, not every member of the audience can reach out to any other member. Mostly, people are seated in rows and the view is limited to the front and the sides. Not many people will look around to get an overview over the reaction of others. The social influence is therefore limited to the individual field of vision. The influence of other productions can also not be excluded from the model. If this factor becomes ignored, the values for q may be higher or lower just because the context of a performance is not examined. Lastly, p itself is a parameter, which does not credit the individual appreciation of the performance by each member of the audience. It can vary from person to person and the depiction of the audience as a homogenous grey mass can cause huge errors especially in intimate settings and controversial performances.

These are points of criticism, which have to be taken into account when trying to model real occasions of the phenomenon. Nevertheless, other general assumptions match the standing ovation phenomenon very well. The way of seeing it as a binary decision, for example, or the meaningfulness of both q and p as parameters of acknowledgement and social interaction for the development of the function give a good impression of how one could generally model standing ovations. Furthermore, we can assume that q remains the same over time since the time span is very short. This is also the reason for the low probability that people change the opinion of the performance during the applause. The Bass Model, as any other model, is a simplification that loses its meaningfulness when being applied to empirical reality. However, as shown in the examples, it gives credit to both social influence and the original opinion among the audience. Therefor it is suited to model the general reaction of the audience. The estimation of parameters like *q* and *p* require models that focus on the individual, like the Theory of Planned Behaviour does. The Bass Model allows the modelling of the reaction among the whole crowd and is therefore able to show both peer pressure and recognition in the audience, which was the intention by writing this paper.

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Response to the peer reviews

In the peer reviews, which Frederick Broers and Teun Boswinkel wrote, both major and minor criticisms are made on my paper.

The first suggestion, to indicate that I did not choose a model that was used in the course, was not adapted after verbal feedback during the review session. It was assured that this statement is not necessary. Secondly, it was noted to give examples of my calculations for the two graphs, which I did by adding the values for p and q to the formulas. The explanation that Q and S turn into p and q is clearly stated in the beginning of the application and is therefore not elaborated in more detail. Another suggestion was to explain the role of q and p in the function in more detail, whereas the second peer review did not mention this issue. I did not another analyses of the term p/q in the description of the Bass model out of fear of lengthiness, but in end of the application and hope to show the relation during the application vividly based on the two thought experiments. The remark about a possible causal model is adapted. This could lead, indeed, to false expectations.

Another remark about the missing calculation of the total amount of people is wrong since it is done in both thought experiments. However, I chose to exclude this equation in the final report because it does not add anything to the understanding of the model. Furthermore, the Sigmoid curve is not a specific curve, but a general description of a curve of S-shaped bounded growth.

The suggestion to clearly label the tables in graph has been included in the final report. I redid both graphs and tables for the sake of clearer presentation. The questions, I asked in my draft, were sometimes answered with contradicting suggestions. I therefor had to choose between the remarks.

Firstly, the necessity of mentioning the s-shaped function already during the process of instantiation was questioned. I decided to leave it that way based on the remark that it helps to visualize the situation and does therefore hopefully not lower the quality of the paper. The positive answer to the question, whether to give an example of p and q, was not adapted, but neither ignored. The examples would include numbers from other research of product adaption and I was afraid it might indicate the application of the Bass model to a different case from mine. Since both reviews assured that the model is still understandable without examples from different cases, I decided to exclude those because it would shift the focus away from the actual case of standing ovations to product adaption.

I furthermore tried to solve the problem of referencing the key assumptions by adding a brief explanation after the enumeration.

The minor comments were mostly made on grammar and I therefore adapted the suggestions. I did still use the word ‘ritual’ because it indicates a certain cultural tradition, which is already associated to a meaning (standing up to show acknowledgement). By using the word ‘ritual’ exactly this meaning shall be questioned (standing up because of acknowledgment *and* social influence). I hope the peer reviews and the adaption of certain points of criticism have clarified the intention and the result of the paper.