

Design in Practical Application, Creativity and Process to form an Expertise

April 2020 Johannes Schaede



Johannes Schaede



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Hello Again!

After the last stretch through the dessert of boredom, we are going to look at more exciting landscapes

L3 Structures outside

1. The market
2. The customer(s)
3. The mechanisms at work
4. Task 3 and Book 3

Each and every design you will create – unless you are a lucky exception such as Jean Tinguely – has a purpose to create value in an economic environment. As much as engineers tend to focus on the technical challenge per se, the rules governing the economic context are evenly important, if not in some cases dominant over the pure function.

Bonus Question : who was Jean Tinguely and in how do you think he is important for the understanding of engineering?

The market

Farm

- Flow of material and goods (trade)
- adding value (productive trade)

Food Chain

- Rewards for added value

It takes place with local and economic alternatives



Remarks from the wooden siege

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A Market is a place for exchange of goods and services which constitute an added value. This applies to the weekly market in Oaxaca, Mexico, to the flagship stores of fancy goods, to the market of industry goods and also to financial markets (an area where the added value to me is hidden most of the times)

Survival with USPs

Unique Sales Points - Decisive factors in the world market

- Increased ROI for the customer
 - speed (sustained NOT max)
 - Reliability (Accident or Catastrophy)
 - Quality (made in XXX ?)
 - Efficiency in resources
- Service
 - Reliable
 - Fast
 - Competent
- Long Term Perspective
 - Upgrades
 - Extensions
 - Subsequent Investment
- Customer relations
 - Person to person contact
 - Reliability (A man a word)
 - Infiltration on all levels
- Design ?
- Safe & Secure ?
- Price ?



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In the area of industrial goods, the valuation of your product is not as simple as the valuation of a loaf of bread or a bottle of wine (though also here the quality can make a lot of difference). In industrial goods the purchasing decision of the customer is based on a whole lot of decision parameters, which if you have an outstanding solution is called a Unique sale proposition:

1. **Return Of Investment:** This is the time it takes that the customer receives back his investment through the economic advantages of your product. It is influenced by the production speed (not the maximum always, but the sustained output with acceptable quality); the reliability, an obvious parameter if think of machines like airplanes or newspaper presses (a small newspaper may be bankrupt, if their daily issue does not go out in time : Why?); the quality (made in Germany still!); efficiency in use of resources such as energy, water, clean air etc.

2. Service

Any re-investment is deeply influenced by the past performance. This performance is ruled by a balance between three parameters: fast, high quality and cheap. However, you can pick only two of the three. In real life the best parameter to drop is obviously cheap. Also it is the basis of trust of the customer to your product and organization. God help you if there is any doubt on your performance. You are just toast.

3. Long Term Perspective

If you are providing investment goods, the customers appreciate a long term perspective. Though it may have the character of museum restoration, in some cases the service for long lasting machines is highly appreciated.

If your products allow cycles of upgrades it is a good basis for future business. As a young engineer have repaired machine which were commissioned before I was born.

4. Customer Relations

All business relations are personal. For the engineers it is important to be reliable. Do what you say, say what you do. If you have made a mistake, admit it AND eliminate it, noiseless. Your reliability in business relations will be counted in the future. In my area of business, I have grown up with the colleagues at the customers who were also the little rookies when commissioning machines. Today they have made their career and make decisions. It is helpful if you have a good standing within your community of peers. Build up a reputation where you are seen as someone who knows what he/she is talking about rather than believing what he/she is saying.

5. Design?

Design aspects of pure beauty are not a parameter – so we think. Be aware that a good solution is in most cases also beautiful. (do you have an idea about a product which is beautiful, yet functional?)

6. Safe and Secure?

Rules which apply to machines are more stringent than anything in real life. Our machines have noise limits which are orders of magnitude below the emission level of a Disco or a pop concert. It is an unknown what degrades our hearing over time par tout. Nobody shall be hurt in a machine. The rules again are more stringent than in ordinary life. For example, you are well advised not to slam the door of your car, when you have your fingers in the door frame. In a production machine you have to suppress this possibility beyond unreasonable behaviour. It is hard to make anything fool-proof as fools are so ingenious.

7. Price?

As you will see, any of the above can be translated into price.

A small little theory : what is my market?

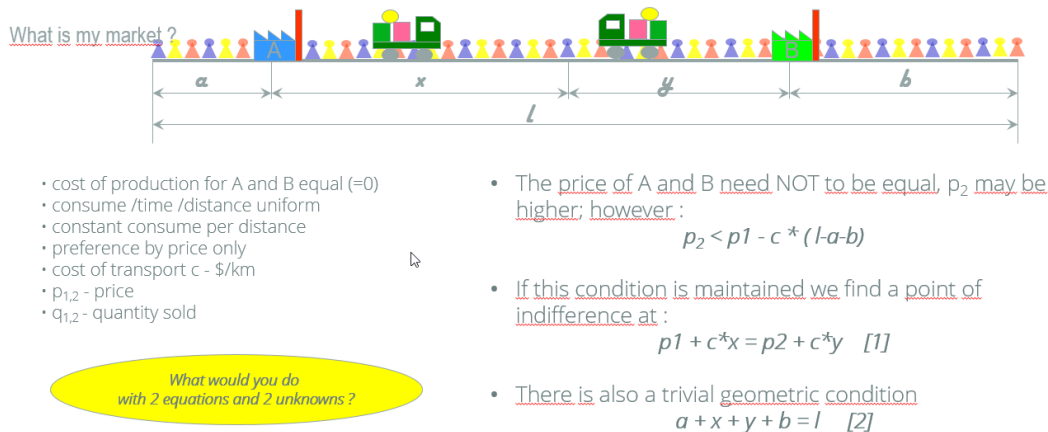
Harold Hotelling, 1895-1973.



Stability in competition; Harold Hotelling ;
the economic journal; Vol. 39, No 153. (Mar 1929)

Even if very complex, the market mechanisms of a competitive market can be understood by a fairly basic theory. Harold Hotelling developed this theory in the last century. He received wide international recognition for his contributions to this field of theory in micro economics and statistics.

A simple linear market



Stability in competition; Harold Hotelling ; the economic journal; Vol. 39, No 153. (Mar 1929)



Remarks from the wooden stage.

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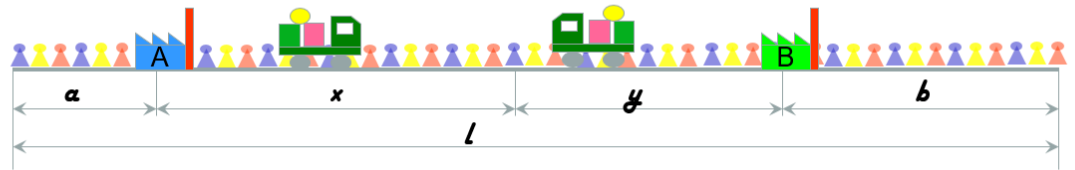
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He created the simplified model of a market as to the above. There are two producers of mineral water. As we all know to produce mineral water is just pumping it out of the source and bottle it. For the simplicity of the model – as it will be disappearing anyway as a constant offset – we set it to 0 for both producers. The consumption of mineral water, over time over the distance l shall be uniform. Thus there is a constant consumption per distance. Consumers decide on price only (Geiz ist geil). The cost of transport for both producers shall be the same c (\$/km). p_i are the prices; q_i are the quantities sold.

The prices for the two producers are not necessarily equal, but they have an obvious limit if no one is inclined to get out of business.

Under this condition we find a point of indifference and with a simple geometric equation we have two equations with two unknowns.

If you abuse it you loose it



- cost of production for A and B equal (=0)
- consume /time /distance uniform
- constant consume per distance
- preference by price only
- cost of transport c - \$/km
- $p_{1,2}$ - price
- $q_{1,2}$ - quantity sold

[1], [2] =>

$$x = \frac{1}{2}(l - a - b + \frac{p_2 p_1}{c}) \quad [3]$$

$$y = \frac{1}{2}(l - a - b + \frac{p_1 p_2}{c}) \quad [4]$$

We find the "market size" for A and B dependent on their pricing p_1 and p_2

Stability in competition; Harold Hotelling ; the economic journal; Vol. 39, No 153. (Mar 1929)



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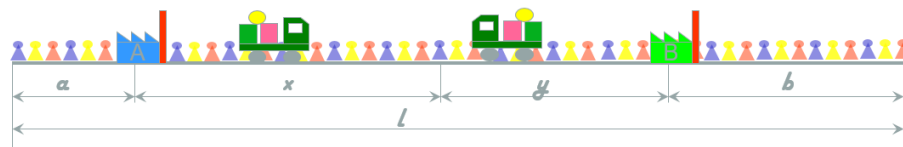
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With the two equations we can determine the market for the two producers

Fear god, tell the truth, make money



- cost of production for A and B equal (=0)
- consume /time /distance uniform
- constant consume per distance
- preference by price only
- cost of transport c - \$/km
- $p_{1,2}$ - price
- $q_{1,2}$ - quantity sold

What about profit with [3], [4] ?

$$\Pi_1 = p_1(a+x) = \frac{1}{2}(l+a-b)p_1 - \frac{p_1^2 - p_1 p_2}{2c} \quad [5]$$

$$\Pi_2 = p_2(b+y) = \frac{1}{2}(l-a+b)p_2 - \frac{p_2^2 - p_1 p_2}{2c} \quad [6]$$

Entrepreneurs will optimize profit !

Stability in competition; Harold Hotelling ; the economic journal; Vol. 39, No 153. (Mar 1929)



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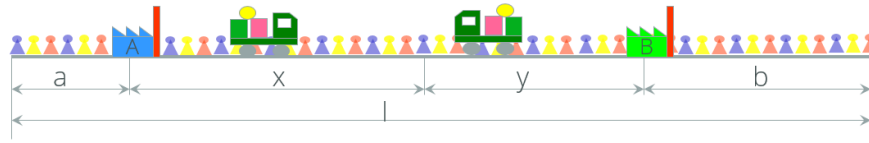
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This leads to the simple assessment of the profits for the two mineral water producers.

Simplicity is beautiful



- cost of production for A and B equal ($=0$)
- consume /time /distance uniform
- constant consume per distance
- preference by price only
- cost of transport c - \$/km
- $p_{1,2}$ - price
- $q_{1,2}$ - quantity sold

What about profit mit [3], [4] ?

[5]

$$\frac{\delta \pi_1}{\delta x} = 0 \Rightarrow p_1 = c(l + \frac{a-b}{3}) \quad [7]$$

[6]

$$\frac{\delta \pi_2}{\delta x} = 0 \Rightarrow p_2 = c(l - \frac{a-b}{3}) \quad [8]$$

Economy follows simple linear equations ?



Stability in competition, Harold Hotelling

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The optimization condition for the profits is a simple deviation of the linear equation.

The interesting consequence is, that for increasing turn-over and profit the producers would need to move their production sites towards each other.

Model reality



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Update V1_3e Mar 10

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Though this is not possible for the mineral water sources, it would be for two mobile ice-cream vendors on a summer beach. What would be the obvious equivalent to the transport cost/km in the mineral water case?

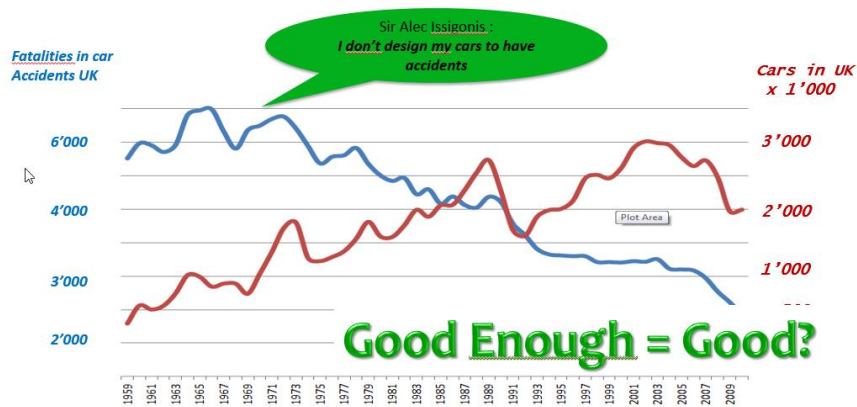
This observation has interesting consequences for the products in competitive markets

The Mini Story



Before we go on I want to illustrate the transformation of transport distance into market parameters. This is the original Mini Cooper, designed by Sir Alec Issigonis. One of the most successful compact cars of its time.

The Mini Story



Source : Library House of Common: Reported Road Accidents Statistics, Standard Note SN/SG/2198; Oct 24th 2013
Department of Transportation UK; Transport Statistics Great Britain: 2011

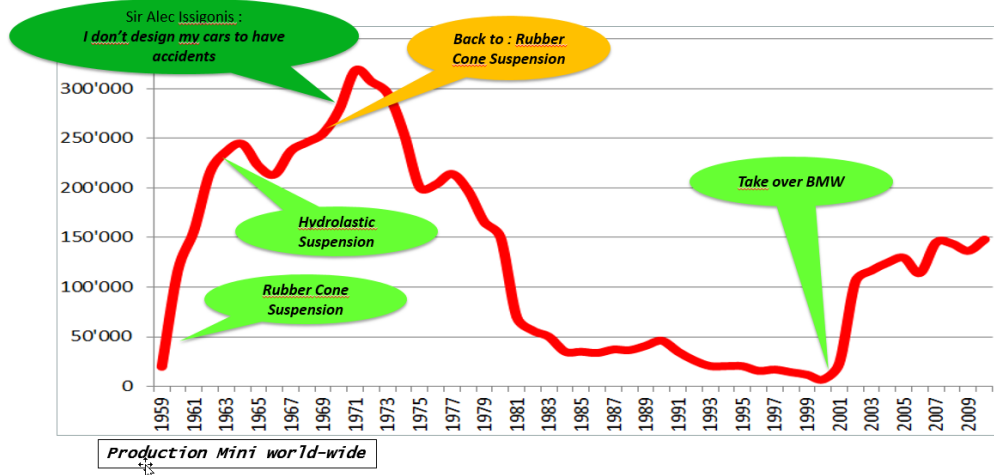
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This is the development of fatal accidents per year and (private) cars populating the British Isles over time. In the late 60s passive safety of cars became a hot topic. In an interview 1969 the designer was asked when he would introduce state of the art safety devices like safety belts and deformation elements in steering and car body. His answer was driven by his pompous overestimation of his ingenuity as engineer. Beware of elderly gentlemen getting out of touch with reality.

The Mini Story



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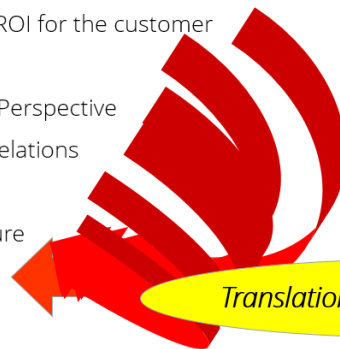
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The consequence is visible in the development of the Mini car sales over the same time period. Amongst other, the design of the mini was no longer acceptable not the least because of the lack of passive safety.

Translation of USPs

Decision parameters for customers :

- Increased ROI for the customer
- Service
- Long Term Perspective
- Customer relations
- Design
- Safe & Secure
- Price



Translation into transport distance!



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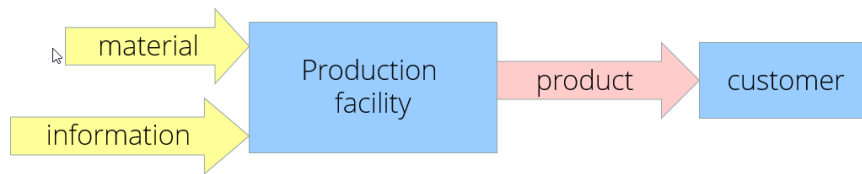
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Coming back to Hotelling and the definition of the USPs, they need to be translated into the price or in the model into the transport distance. The tendency of the competitors to move towards each other is well visible in the almost total exchangeability of cars and their technical parameters within a certain class. Q: why is there still a difference in price for an Audi in comparison to a Hyundai in most markets?

Understand market context



As A stupid engineer I try to understand the complexity of economic interdependencies with more simple models. Maybe it helps you later – as it did for me in the past – to evaluate markets and their behaviour for your - strategic - decisions. You may not believe it, but sooner or later you will be involved in those. Either in doing them actively or in ignoring them. The latter is not advisable. A bad decision which is corrected in an early stage is always better than no decision.

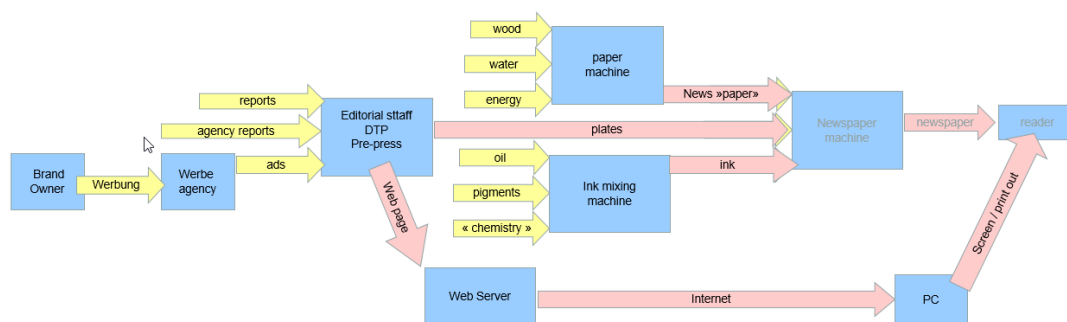
The most simple unit in an model is a production facility, which turns material(energy) into a product and makes it available (sells) it to a customer.

Q: does this apply to a farm, a bakery and Phoenix Contact?

Understand your position

example : newspaper

What is my market ?



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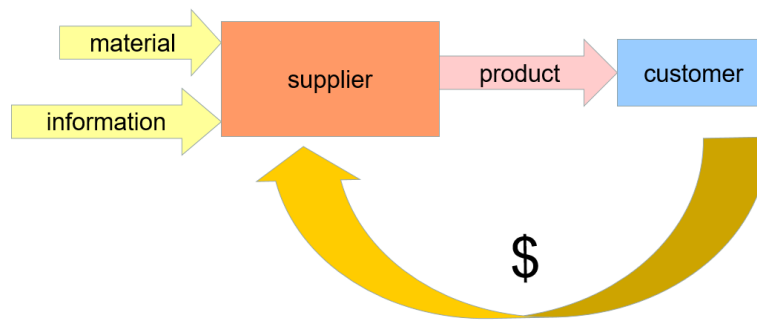
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In all regular cases it is not as simple as the basic unit. I have for you a still simple model of the total market in which a (newspaper) printing machine manufacturer is positioned.

Try to understand the interdependencies before you continue.

Follow the money

What is my market (food chain)



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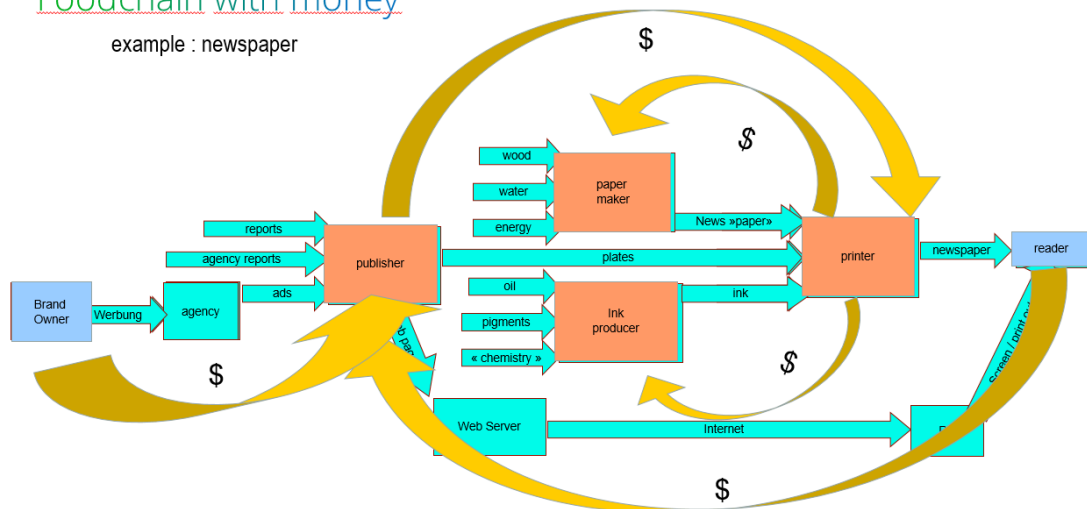
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Now the first approximation lacks an important element. If you want to understand (any) motivation : Follow the money.



Foodchain with money

example : newspaper



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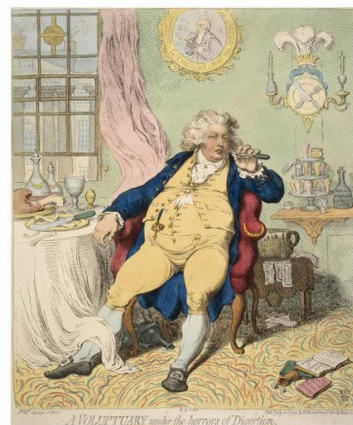
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This small addition is quite helpful. If you understand what market participants want :

What does the market participants want?

- Minimal effort
 - purchase goods
 - use of resources
 - minimal turn around
 - minimal risk
- maximum profit



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Like every intelligent person any market participant wants to have a good life at minimal effort. Try to prove me wrong, but rest assured, whatever people tell you they are possibly a case for the doctors if they claim, they do what they do for the beautiful blue eyes of their customers. This is even not true for the coffee selling George Clooney.

Q: wehre is the spelling error?

Predictions and their fullfillment

newspaper, predictions

- 1989 b&w : newspaper will be replaced by private TV and internet
- 1995 Bill Gates : the last news paper will be printed in 2005



Das Internet verdrängt immer mehr die Zeitung.



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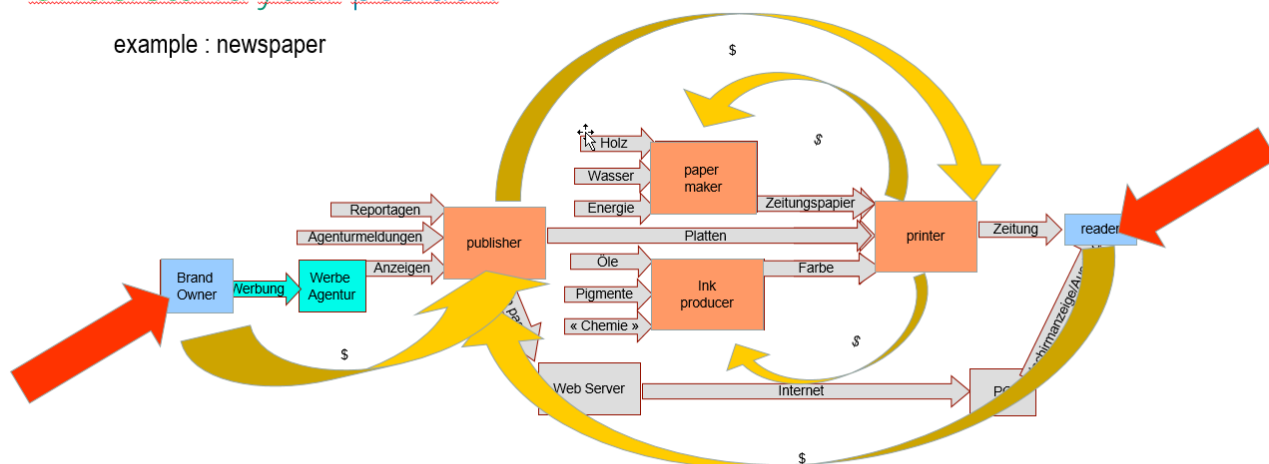
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Predictions are rather difficult, especially when they deal with the future. Here are some for the newspaper (printing) though the glorious good days are over for the machine builders, a lot is still printed in newspapers and magazines (think of a kiosk in the train station)

By the way, Donald Trump has done a lot for the survival of newspapers in the US. Subscriptions for the large national papers in electronic and paper forma have soared in the last three years. Have you any idea why this is the case?

Understand your position

example : newspaper



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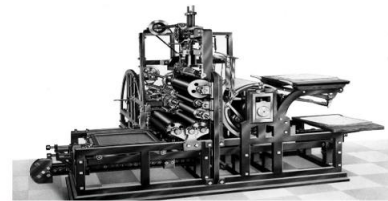
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Having introduced the money stream into our newspaper machine food chain, we will understand who are the most important players for the good future of the machine builder:

It is not the printing house, nor any other material supplier. It is not even the publisher so much. Those who determine what happens to you are sitting at the respective ENDS of the food chain: The publisher and the reader.

Now I invite you to try and understand what is going on at these ends:

KBA: oldest printing machine manufacturer in the world



Erste Zylinderpresse von 1812

- 1812: Friedrich Koenig builds first steam engine driven printing machine
- 1814: 360 years after Gutenberg the Times in London uses the first two presses
- 1817: Friedrich Koenig und Andreas Bauer are founding Koenig & Bauer in Oberzell near Würzburg



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Erste Inkjet-Rollenmaschine zur drupa 2012

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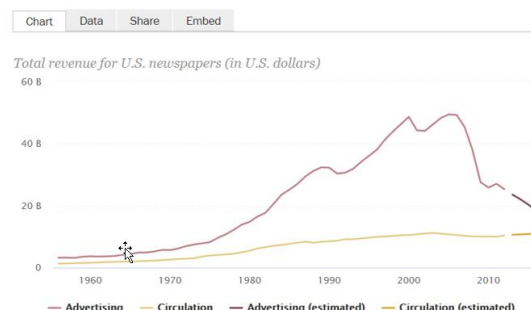
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24

The company I am working for is today 202 years old. It was founded by an ingenious engineer Friedrich Koenig and a very able production expert and mechanics Andreas Bauer. They built their first double cylinder press for "The Times" of London. The owner Sir John Walter replaced about 100 strong men with Gutenberg Wine presses in one night with 6 engineers and a press which printed by rolling a cylinder over a plane. Q: Why was this principle so ingenious and disruptive?

KBA: decline of the newspaper

Newspaper industry estimated advertising and circulation revenue



Source: News Media Alliance, formerly Newspaper Association of America, (through 2012); Pew Research Center analysis of year-end SEC filings of publicly traded newspaper companies (2013-2016).



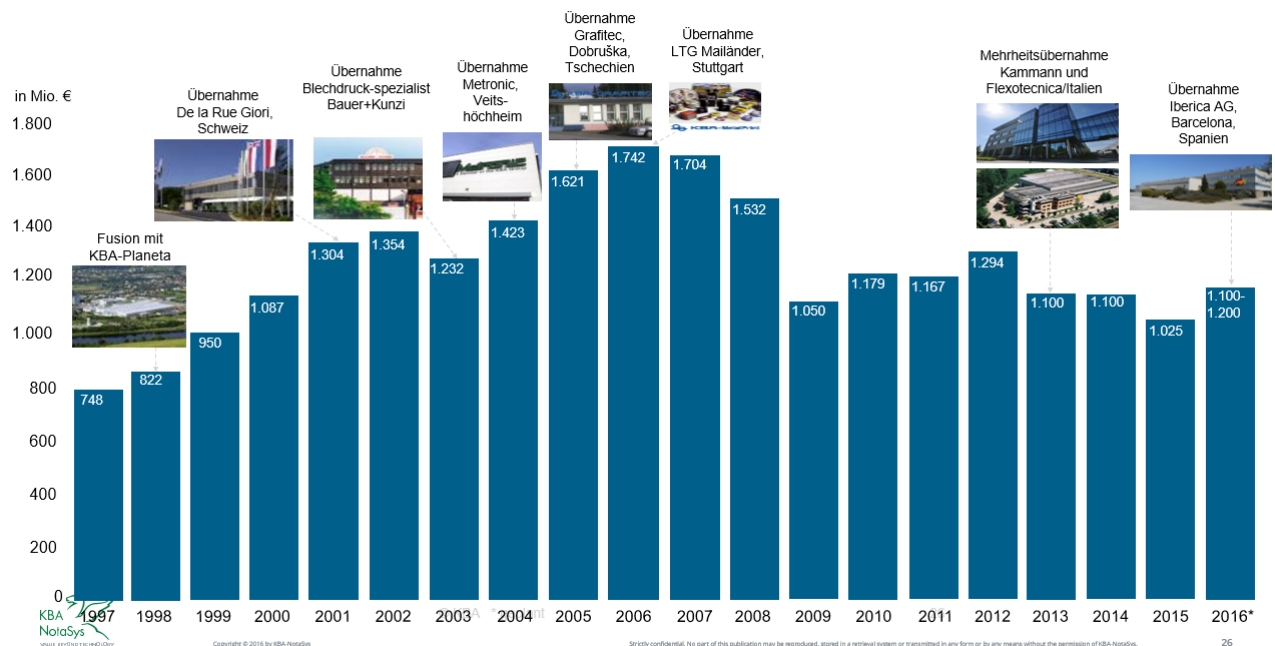
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If you look at the decline in printed newspaper over time versus the spending of advertisement budgets : what was the real driving factor in the decline of newspaper printing?

KBA-Gruppe: change in portfolio



Looking at our development over this critical period, you will notice the impact of the declining newspaper business. It is accelerated by the Molotov Cocktail of the (Lehman Brothers) Sub Prime Loan Crisis.

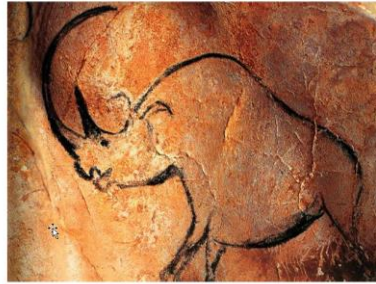
Q: why are we still there?

Reading traces



To understand this better let us look at the other end of the food chain, the reader.

Man develops script



Cave paintings approx. 30.000 ac



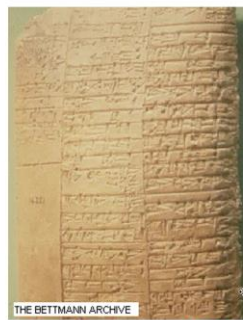
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To develop newspapers, man had to develop script. The first abstract documentation we know about are cave drawings from about 30.000 years ago.

Man develops script



Mesopotamia approx. 4.000 ac



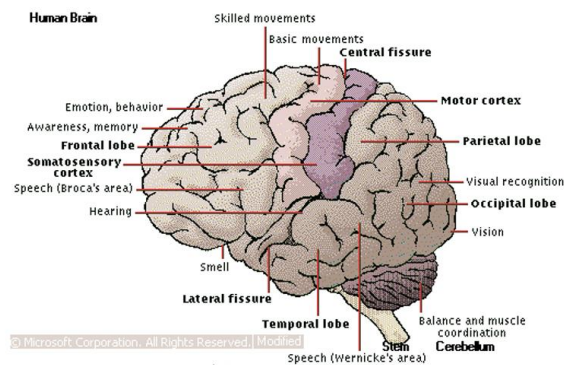
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More stringent we find the first script in the modern sense at about 6.000 years ago.

brain homo sapiens



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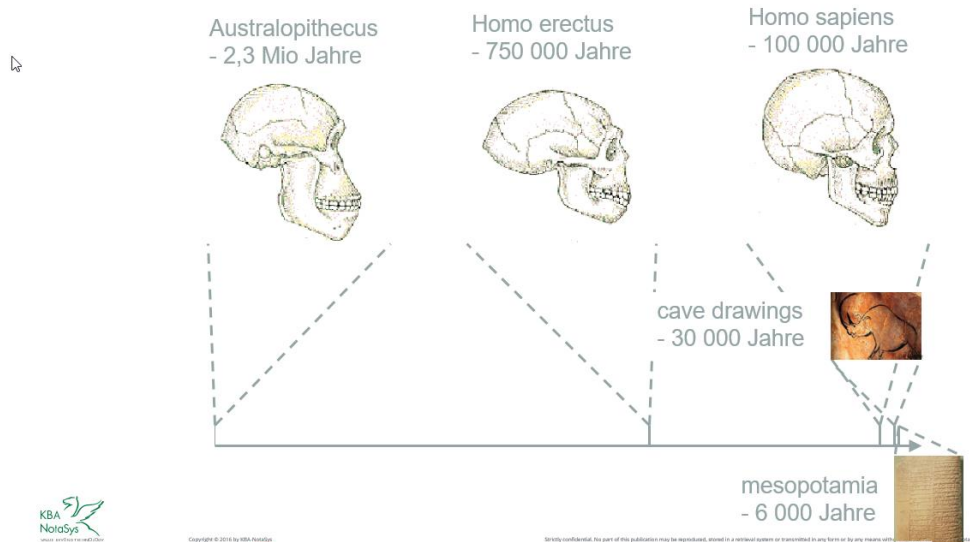
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As you are well aware our brain has certain dedicated areas for reading and writing.

Anthropologists and Specialist in early development of mankind could reconstruct that these areas in our brain stem form evolution at around the appearance of Australopithecus approximately 2.3 Mio years ago.

Evolution homo sapiens

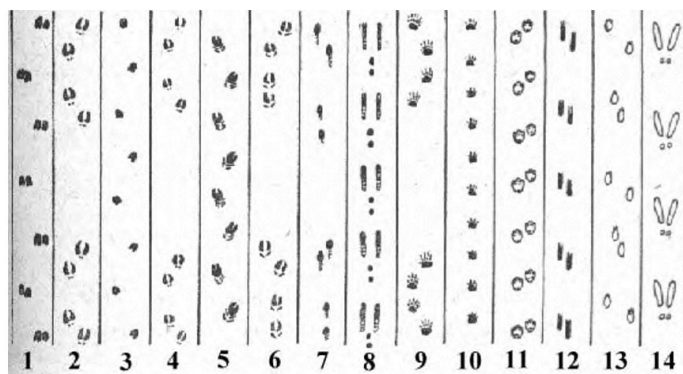


This is highly surprising, because how would evolution know about so early in our evolution that we would need these areas of our brain to read later on a newspaper (not older than 500 years) ??

Professor Grüsser in Mainz a media ecology expert asked the symmetric question:

What are people doing with this brain area, who by their education (e.g. Untouched people in the Brazilian jungle)?

Traces of animals (edible !)



It is simple: they read traces(!). Is it an animal good to eat or dangerous or both? How long ago did it pass? Is it worth to pursuit or to climb the next tree? In short, when reading traces or abstract strings of signs, you are creating a much more complete imagination of reality, than what is actually there to see. It is a typical human capacity called a "pars pro toto" function. That this is very individual, still common can be understood if you visit with friends a movie made after a book you have read. Nobody is satisfied with the movie but the reasons of discrepancy between expectation and movie are different for everybody.

Stanford Study eye saccades



In several studies psychologists have found that attention is created by images but content is transferred – mostly - by script, i.e. abstract strings of signs.

That this is so is easily demonstrated with these black greyscale images of the reverse side of our bank notes. Try to assign these sides to the right denomination within 30 seconds (without cheating !)

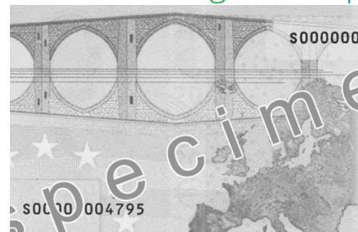


image or scripture

Perception distribution eye

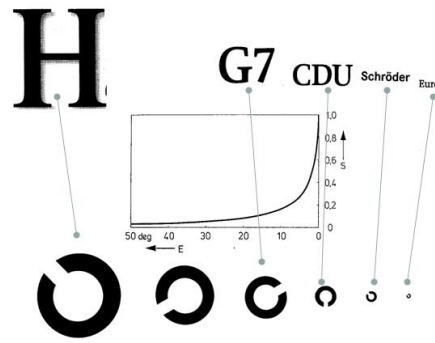


Abb. 4.7 Oben: Abfall der Schärfe mit wachsender Exzentrizität E in Grad angenähert durch die Funktion $1/(1+E/2)$. Unten: Kompensatorisch entsprechend ihrer peripheren Lage vergrößerte Landoltringe. □



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Funny enough the distribution of size in headlines roughly with the sharpness in vision reception in the periphery of your eyesight when focussing on the centre of a newspaper page. Reason: Your subconscious scans the rest while you are reading.

Absorption of attention when reading



"You couldn't have been listening. If you'd been listening, you'd be mad."



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The intensity of focus, when reading is a matter of every day's experience.

3 B = Bed, Bath, Beach



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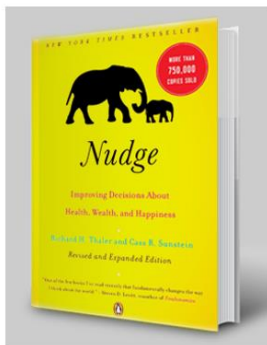
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Lastly, a newspaper or magazine still offers some advantages in convenience. It is less expensive than your iPad when stolen on a beach. It will not go away so fast.

With this small excursion you will understand why it is a good idea to open your eyes and look across a wider context to understand what goes on in your market(s)

A reading recommendation



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Finally, a recommendation: read! Also Newspapers! It is not a good standing when you speculate in a small talk - with an HR guy of the company you want to work for – whether Christine Lagarde is a former singer-song writer from the last century sixties. . .

A small exercise, if you want to:

Make a sketch of the food chain model for Phoenix Contact.