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Adapting to social change via open innovation

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Table of Content

1. Introduction	3
2. On the nature of social change.....	4
3. A deadly mixture	8
4. Car bombs go around the world.....	13
5. Conclusion.....	16
Bibliography	19

1. Introduction

Ogburns (1964) is said to be the first sociologist who wrote about the importance of tools for social change (Weinstein 2005: 179). Ogburns introduced the thesis of a ‘cultural lag’, that is material culture develops faster than social habits adopt and maladjustments occur. The reason is, that innovation occurs faster where a rich material base is provided and therefore material culture accumulates. In this paper I shall examine one specific innovation, firstly show how it spread around the world, secondly how it was alternated according to the circumstances, and thirdly how adoptions were done. The example I use is an uncommon one: the car bomb. Why using such a strange example? It is surely interesting and that would give a good reason. But this is not the only one. Moreover it exemplifies Ogburns’ theory of the ‘cultural lag’, the process in which innovations occur and therefore social change is possible. A third reason to choose the car bomb as an example is because I do think it is a good example of an ‘Open Innovation’. A group or community does these innovations and everyone knows the object of innovation with all its technological features. This means it is not protected by copyright but information for its alternation is freely available to everyone interested.

My thesis is that the history of the car bomb gives proof to Ogburns’ idea of the ‘cultural lag’. Contrary to many theories of innovations, the history of the car bomb is a story of social change and the availability of information for its production and use are widely spread and many independent and connected groups improved it, collaborating or not. This specific process of innovation is uncommon in innovation theory because this material innovation has not been made inside a corporation but in an ‘open’ process. This adds to the importance of the car bomb for social change and to the understanding of the ways in which social change might be enforced.

As I investigate the topic not from a political point of view but I am interested in social change, I will focus on issues related to change. Matters of political importance are often interwoven, but spared here. They do not add information to the answer of my research question. The car bomb remains an example only and the author does by no means wish to imply the use of such a cruel – or any other – weapon. The empiric data should therefore not be considered a political point of view. Who bombs whom why is reported as ‘facts’ and not as a statement of agreement with the terrorists’ actions.

I will start with a recapitulation of Ogburns’ theory of social change, innovation and the cultural lag (1964). After giving this theoretical framework I will focus the next chapter on my case study. The history of car bombs (Davis 2007) is repeated and related to some circumstances (e.g. Davis 2006; Weinstein 2005). A brief glimpse about its future importance is given, because in a lot of places social problems and differences increase and new spots of urban warfare emerge (Davis 2006). After relating car bombs to theory and to social surroundings, I will concentrate on the process of their innovation. In what kind of innovation processes were they invented, diffused and improved? After finishing this, we will have a look back over our shoulder and reconsider what had been shown and can be learned out of this paper.

2. On the nature of social change

First thing to do is to give a theoretical framework. I will primarily rely on Ogburns (1964) in this chapter. When Ogburns wrote his book, his thesis was groundbreaking. He added the idea of cultural change to biological change, as described by Darwin. Ogburns does not give a clear definition of his understanding of culture, he subsumes

mankind's social heritage under this term. I will restate Ogburns basic arguments about social change that lead him to his thesis, that material culture accumulates and social adoption lags behind. Material culture grows faster than adopting culture – or the social organization, mental culture, however it is named – and the social maladjustment increases. This constant maladjustment calls Ogburns a “cultural lag” (1964: 200).

The reason material and adaptive culture diverge is inventions. The amount of inventions is dependent on the “cultural base” (Ogburns 1964: 82), that is the amount of former inventions and social heritage the inventors can rely on. As the amount of inventions grow, the premises are enhanced, more inventions are possible and easier to reach and therefore the probability of further inventions rises. With more and better tools ad hand, it becomes easier to construct more and more new tools. This process is closely connected to the division of labour. A self-amplifying circle is established.

On addition to the increasing possibilities of new inventions, old material culture is not forgotten at the same rate (Ogburns 1964: 74). Often old material culture is connected with “sticky” habits and the new invention is not diffused to every part of a culture or different groups. Sometimes the utility of an old part of the material culture changes. An example is carriages, which remained in use after the invention of the automobile. But their use changed from transport to a leisure time (Ogburns 1964: 157).

Nowadays we find it common to have a positive value of change, but this attitude is specific for modern western culture and cannot be taken for granted along all different cultures around the world (Spindler 1977: 3). Ogburns emphasized that this view of change as inevitable and good results from the ongoing exposure to constant social change to the better the western cultures experienced during the modern period (1964:

111). This positive attitude towards change further enforces the appearance of even more social dynamic.

Ogburns summarizes the process as follows:

Material culture appears to grow by means of inventions which are seldom lost but accumulate. Thus the material culture grows larger and larger. As the material culture grows larger more inventions are, on the average, made. The extent of the material culture base is a factor in the frequency of inventions. Thus material culture tends to accumulate more rapidly. The result is more rapid social change, increased specialization and differentiation. (Ogburns 1964: 140)

The change in material culture occurs at a higher rate than the adoptions in mental culture and social organization. The core drivers for the latter change are adoptions to changes in material culture. It therefore follows a lag in adjustment. The result is a “cultural lag” (Ogburns 1964: 200). An opposite cause-effect-chain may be true but Ogburns considers it empirically far less relevant (1964: 268-280).

Since lags in social movements causing social maladjustments follow changes in material culture, and since there are many rapid changes in material culture, it follows that there will be an accumulation of these lags and maladjustments. (Ogburns 1964: 280)

Ogburns is a sort of a doomster concerning material culture because according to him it causes cumulative social maladjustments. Moreover, every attempt for development necessarily leads not only to improvements of the material culture but also to further maladjustments. Simmel named this process the “tragedy of culture” (2001). Culture bears its own problems within itself. However, this model of social change relies primarily on changes within a culture and not on adoptions to environmental change, as it is discussed today (e.g. Diamond 2005). I am completely aware of the importance of such influence factors but I do not consider them important for answering my research question. Therefore, I will not undertake any further investigations in this direction. Due to the fact that the phenomenon I scrutinize here is a global one, we need to study the

processes of diffusion and acculturation because both of them take place between different cultures. Furthermore, because Ogburns is so anxious about stressing social change, he underestimates factors as environmental impact and demographic changes (Weinstein 2005: 55-85). It can be assumed that the accumulation of material culture and the demographic transitions are closely connected. This would give an explanation why such an accumulation could start to occur.

Diffusion obviously only occurs where two cultures meet, even when “contacts are rare and distances great” (Ogburns 1964: 89). With intensive contacts cultures tend to grow rapid. Contrary, cultures without contact change relatively slow or almost near to stagnation. Therefore, beside invention, adoption of material and/or mental culture or social organization is a major source of great social change (Ogburns 1964: 89). Geographical isolation may act as a barrier to diffusion and acculturation as a special case of diffusion (Ogburns 1964: 161)¹. Jones (2006: 48, 88-92) especially emphasizes the importance of economic relations between cultures for the diffusion of inventions. Next to trade, war is a major source of acculturation, because the conquered side often adopts the winners’ habits, only in rare cases the winning forces merge with the defeated elite.

Resistance to change does not alone occur where there is only seldom trade or other exchange but also where there are great differences between the cultures. Inertia has to be overcome in order to initiate change (Ogburns 1964: 161-165; Lewin 1963). Ogburns assumes that cultures adopt wherever it is functional. His hypothesis in this point is that “culture once in existence persists because it has utility” (Ogburns 1964: 193). “When there is no strong incentive to change or rather no strong disincentive against sticking

with established habits, change is likely to be slow” (Jones 2006: 29). Later on it will become obvious why there are indeed strong incentives for improving the lethal weapon. Very like a T-Shirt in the global economy travels around the world (Rivoli 2006), the same is true for inventions definitely unhealthy for human society. The diffusion, production and logistics of the car bomb might also be a reaction to free trade, but free trade plays no crucial role in the way car bombs are invented, as will be shown in the following pages.

3. A deadly mixture

The first incident that can be called a car bombing happened in September 1920 in downtown New York City, actually Wall Street. Today’s best-known car bomb shook the very foundations of the temporary world: 9/11. The target was not far from the first made assassination, but the weapon was several times more powerful. The last thing the terrorists added were wings. I shall give an overview of all the ‘improvements’ that had been made over time (Davis 2007: 8).

Davis (2007: 8-11) highlights six factors that qualify car bombs as perfect weapons for underground terrorist groups in urban warfare. First, as cars are early everywhere they are stealth weapon with incredible power. Second, they are ‘loud’ and probably being heard by the mass media. Third, they are cheap: Timothy McVeigh’s assault in Oklahoma city, leaving 168 dead cost him only \$ 5000. Fourth, they are operationally simple to organize. Fifth, they demoralize a society because collateral damage is nearly

¹ Examples are often used because easy for comparative sociology, cause-effect can be traced down (e.g. Diamond 2005: 79-119, 277-308).

inevitable. Sixth, they leave only little forensic evidence. These factors together make them “poor man’s air force” (Davis 2007: 8).

Innovation	Year	Place	Group
Modern prototype	1920	Manhattan	Italian anarchist
Truck bomb	1947	Haifa	Stern Gang
Multiple car bombs	1948	Jerusalem	Palestinians
Hybrid: car bomb + other explosives	1964	Saigon	Viet Cong
Used against embassy	1965	Saigon	Viet Cong
Ammonium nitrate/fuel oil bomb	1970	Madison	„New Year’s Gang“
Economic warfare	1972	Belfast	IRA
Death in excess of 100	1981	Damascus	Moslem Brotherhood
Kamikaze truck bomb	1981	Beirut (Iraqi Embassy)	Syria?
Attack video-recorded	1982	Beirut	Hezbollah
1-ton TNT equivalent	1983	Beirut (US Embassy)	Hezbollah?
Major geographical impact	1983	Beirut (Marines)	Hezbollah
Female suicide car bomber	1985	Lebanon	SSNP
Used in regularly military attack	1985	Sri Lanka	Tamil Tigers
Mass technology transfer	1985+	Pakistan	CIA/Pakistani ISI
Targeting tourism	late 1980s	Corsica	FLNC
Entire neighbourhood	1992	Lima	Sendero Luminoso
Cultural heritage	1993	Italy	Mafia
More than \$1 billion damage	1993	London	IRA
Against voters	1995	Johannesburg	White suprematics
5-ton TNT equivalent	1996	Dhahran	Hezbollah/Iran?
Simultaneous, several cities	1998	E. Africa	Al Qaeda
„with wings“	2001	Manhattan	Al Qaeda
Nearly starts nuclear war	2001	New Delhi	Pakistani ISI?
More than 500 fatal bombings	2003-06	Iraq	various

Table 1: Car Bombs: Lethal Thresholds (Source: Davis 2007: 8)

Table 1 shows an astonishing list of improvements, but when it comes down only a few different kinds of innovations have been applied. The first type of innovations concerns the bomb itself, e.g. the destructive power of the bomb. Second are organizational improvements like suicide bombers or synchronization of several explosives. Third are target improvements, which were either more efficient or caused much more terror, e.g. bombing London banks or videotaping. Fourth are more efficient kinds of uses, e.g. better covering or transfers to other kinds of vehicles, this again are technical improvements.

The technical uses are more or less the same within all terrorist groups since the invention of the ammonium nitrate and fuel oil bomb 1970. This invention has made all components easy for access, as the knowledge had been before, and building a car bomb became cheap. Moreover, car bombs are very efficient and effective. Therefore, car bombs have been used from combatants all over the world. Davis (2007) *Brief history of the car bomb* in fact tells the reader who when bombed what in detail. The groups using car bombs often showed no scruples, as Table 1 shows terrorists (also state terror) or criminal groups were likely to use them. In most cases they fought for independence (Davis 2007: 98-99) and these higher ends justified collateral damage in their eyes. Political circumstances had the deepest influence on how car bombs came into use. Targets and organization were very much influenced by the ongoing fights. The background of the terrorist group influences if suicide bombers were admitted or not, whether multiple bombs were used, targets were military or civil and so on.

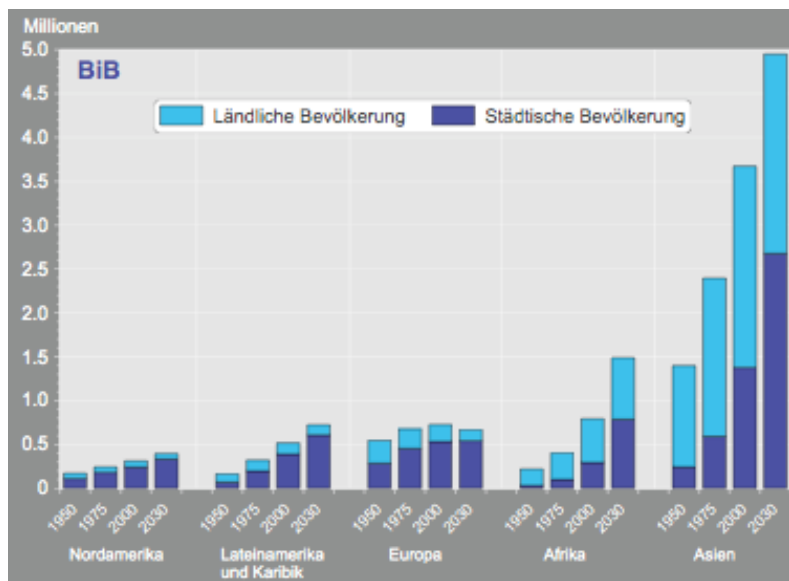
As technical uses and infrastructure do not differ very much by assaults with car bombs all around the world, social application does. It seems that material culture is diffused easily but adoption takes time and often goes different ways, mainly influenced by the existing cultural background it is acculturated into.

The *Great Transformation* (Polanyi 1978) that drove people into the cities is largely done in Europe. But industrialization goes on in many Third World countries and subsistence economies change to market based economies. Labour, land and money become commodities (Polanyi 1978: 103). For Polanyi the consequences of too fast social revolutions are loosened social ties (Polanyi 1978: 112). Such problems should be expected to be one reason for conflicts – other might be religious, political, and so on. Davis (2007: 98-99) stresses the importance of fights against occupying forces.

However, all of these circumstances by far provide incentive enough to innovate. Circumstances of revolutionary change and crisis make it likely that new technologies are accepted if the help to overthrow the enemy.

Cities are the hotspots of the utilization of car bombs. Targets for car bombs are nearly always strategically important points in cities like embassies or they are used in crowded inner city areas. These weapons become more and more normal as the number of inhabitants in cities grows, social problems in cities increase and fights are more or less a civil war or at least fought inside a countries border. If we consider the development of cities in the next decades we might assume what the future of the car bomb is likely be to.

The total number of inhabitants in European cities stagnates but is rapidly increasing in other areas all around the globe (Bib 2005: 84). In Latin America and Africa the total numbers increase until 2030, in Latin America an especially Asia the number will double until 2030 (Tab 2).



Tab. 2: Demographic Development until 2030 in cities (dark blue) and rural areas (light blue), Bib 2005: 84

It is not only that the number of inhabitants in the Third World cities increases but there are also a number of mega-cities with over 10 million inhabitants. Such gigantic cities primarily emerge in the Third World (Tab. 3)

1950		2000		2015	
Rank/City	Population	Rank/City	Population	Rank/City	Population
1. New York	12.3	Tokyo	26.4	Tokyo	26.4
2. London	8.7	Mexico City	18.4	Bombay	26.1
3. Tokyo	6.9	Bombay	18.0	Lagos	23.2
4. Paris	5.4	Sao Paulo	17.8	Dhaka	21.1
5. Moscow	5.4	New York	16.6	Sao Paulo	20.4
6. Shanghai	5.3	Lagos	13.4	Karachi	19.2
7. Essen	5.3	Los Angeles	13.1	Mexico City	19.2
8. Buenos Aires	5.0	Calcutta	12.9	New York	17.4
9. Chicago	4.9	Shanghai	12.9	Jakarta	17.3
10. Calcutta	4.4	Buenos Aires	12.6	Calcutta	17.3

Tab. 3: Top Ten Largest Urban Agglomerations 1950, 2000, and 2015 in Millions, Source: Weinstein 2005: 220.

This “hyperurbanization” (Weinstein 2005: 222) is caused by ‘Great Transformations’ going on in the Third World (cf. Davis 2006: 14-15). On the individual level they appear to be the promises of the cities, but often there are no alternatives. For the majority, life in these cities is not that of a white-collar worker but reminds very much of Dickens’ stories. People there live in shantytowns.

Cities have absorbed nearly two-thirds of the global population explosion since 1950 (Davis 2006: 1-2). Not the cities per se grow, but slums do (Davis 2006: 17). According to Davis the number of slum inhabitants has reached 1 billion by now (2006: 19). This exemplifies the increasing inequality and insecure political conditions. Davis lists 14 slums with a population exceeding 1 million (2006: 28). How this causes violence can be seen in the Near East, where the Palestine refugee camps became permanent and fights with the Israelis continue now for over 50 years. Car bombing was and is

omnipresent in this region. This situation may result from the population explosion and the combined political turmoil in the concerned cities.

4. Car bombs go around the world

Economists studying culture often assume that cultural change is driven by innovations for the market (e.g. Chirot 1994: 117-131). Given that the market is a relatively new idea, this would deny all attempts for social change before a time around the late 18th century. There must be other incentives than purely economic ones. To understand their motives, the last chapter gave a rough overview of related social problems caused by social change. My approach in this chapter is to study groups or communities of innovators which act on their own behalf².

Who are car bombers? Every militant group all over the world is a possible user of this deadly technology. They are “a chaotic spectrum of enemies, spontaneously generated by the contradictions of globalization as well as by the blowback of past policies” (Davis 2007: 149). What the completely different groups had in common were access to the know-how and a use of public relations.

A how to manual about car bombs is fairly easy to get, be it from a public library or in the Internet. The same is true for the needed components. Since 1970 everything necessary for a car bomb can be bought in stores. It's not necessary anymore to steal explosives from Military bases or mines but ammonium nitrate and fuel oil can be mixed to an equally highly explosive substance (Davis 2007: 8-9). New technologies

can be said to “empower” terrorists to use car bombs: “the car bomb *plus* the cell phone *plus* the Internet together constitute a unique infrastructure for *global networked terrorism* that obviates any need for transnational command structures or vulnerable hierarchies of decision-making” (Davis 2006: 11-12, original emphasis). Thus, car bombs are “open source” (Davis 2006: 11) weapons, built via the DIY principle. They are powerful weapons in David’s war against Goliath.

What can ‘Open Innovation’ then tell us about the invention and the diffusion of the car bomb? ‘Open Innovation’ mainly relies upon open source projects i.e. software production by users. Terrorists can rely on an “information commons” (von Hippel 2005: 29) like computer programmers do. Information about the production of car bombs is freely shared. Open innovation is based on shared knowledge, because here innovation is not done by a group of specialists but by collaborating users. Usually in such situation a “free-rider” phenomenon occurs but in terrorists communities the intra-group coherence can be regarded as high enough to give appropriate incentives for knowledge sharing. Additionally, unlike other inventions, terrorists lose nothing if the information about car bomb production is widely spread – this only increases the fear. Barriers about knowledge sharing are low and “free-revealing” of information no uneconomic behaviour (Piller 2006). Therefore, diffusion of in-depth knowledge about car bomb construction is not at all surprising.

The reasons for diffusion are clear, but how about inventions? Why should terrorists improve bombing technologies and not only apply them? Inventions need a great effort. As terrorists have very high risks, car bombs need to meet their specific requirements in

² Most of the literature about ‘Open Innovation’ is management-centred and tries to establish monetary rewards for innovative consumers (cf. Lüthje 2004; Franke & Shah: 2003; Lüthje et al. 2002; Hienerth: 2006; Raabe: 1993; von Hippel 2005).

every detail. Often the success of their enterprise is predicted by the power of the car bomb. Obviously improving the bomb is crucial to success and motivation enough³. What makes it so easy to improve car bombs? Similar to software code they are built out of many independent and simple parts, each of them object of change. “Codebases that are more modular or have more option value increase developers’ incentives to join and to remain involved in an open source development effort; and decrease the amount of free-riding in equilibrium. These effects occur because modularity and option value create opportunities for the exchange of valuable work among developers.” (Baldwin & Clark 2005: 1) Collaborating in open innovation becomes much easier if everyone only changes small pieces and these improved pieces fit together. Afterwards constructing a car bomb is like playing Lego: a brick here, and a module there, and there you go. “Our model suggests that the more modular and option-rich the underlying designs, the larger and more active the user-innovator communities are likely to be.” (Baldwin & Clark 2005: 29) What Baldwin and Clark found here are the benefits of the division of labour within users, not professionals. Adding wings is no big invention but effects are increased multiple times.

Several factors add to the ‘success story’ of car bombs. First, the object’s architecture allows an architecture of participation and collaboration for innovation – labour is divided. Second, incentives for both, knowledge sharing and diffusion are high. Third, access to knowledge and constituent parts is easy. Fourth, external motivation to invent is high, as is the social pressure in the innovating groups. Fifth, information and communication technologies act as accelerators. Last but not least, social and political problems of all kinds. All of this together allowed the morbid success.

³ I will not go here into details about psychological motivations, but I am very much aware that this is a topic that might be investigated in detail and is very specific here (cf. Davis 2007: 98-99; Lin 2001, 1999).

5. Conclusion

I started this paper with the thesis that the history of the car bomb could proof Ogburns' concept of the 'cultural lag'. In the end this can only be considered partially true. Obviously the car bomb is an invention, which occurred out of social maladjustments, but it seems to be the rare case here, where an invention follows social change. The car bomb is changed according to social circumstances rather than the other way round.

Even though chapter two gave an overview of social problems, they are more cause than effect related to the invention of the car bomb. Nevertheless, there is a 'cultural lag' accountable for the invention and material culture, mental culture, and social organization are very closely related when it comes to social change.

In the case of the car bomb culture does not behave 'sticky' but knowledge is shared and diffused, the technology adopted all over the world. Adoptions are nowhere exactly the same as the original utilizations but inventions are made to make the technology fit to the specific social environment.

As I stated, the technology-related improvements are not the most important ones in the history of the car bomb. One or two technical improvements that helped to make it cheaper and stronger are of importance but beside that socio-cultural changes had much more influence on the diffusion and acceptance around the world. After the combination of ammonium nitrate and fuel oil as a new explosive 1970 only slight technical improvements were reached. Construction knowledge was spread afterwards, especially by the CIA from 1985 onwards (Davis 2007: 90-96) and improved communication

technologies played an important role in the fast distribution of the deadly knowledge into every and the last corner of the world.

Most changes in the utilization of the car bomb were reached on the organizational level. Terrorists became networks, suicide bombers increased the terror as did video-taping. Main alternations occurred in targeting: economics, tourism, cultural heritage, voters, embassies, military targets, civilians, entire neighbourhoods, politicians and so on. Every new conflict and every change in the conflicts brought a new target with them. Car bombers even car bombed car bombers (Davis 2007: 26).

What is special about the invention of the car bomb is the open process of improvement. Once the technology track was there incremental improvements were added from little independent terrorist groups all over the world. This could happen because the process of innovation of the car bomb is very much alike an ‘Open Innovation’ process. The how-to code had been an open source code like software code from the very beginning. With the time global ‘information commons’ developed as there was no rivalry between most of the terrorist groups (even though there was intense combat between some of them).

The social problems, political crisis’ and occupations gave strong enough motivations to continue improving technological and organizational features of the car bomb and its uses. 9/11 is only the most dramatic staging of a car bomb assault.

Contrary to many theories of innovations, the history of the car bomb is a story of social change and the availability of information. I focused on car bombs as a very special type of innovation and placed it into a major theoretical framework of social

change. Even though I took an example not exactly fitting to the theory, the theory remains applicable. Ogburns focused on social change driven by changes of the material culture and in this single case my research suggests the opposite direction in the cause-effect chain. Having in mind the complexity of social systems this might be no more than a guideline and causes and effects might be much more complex than I was able to highlight here. For example no political and psychological influence factors were considered in this paper. Both areas can be starting points for further research.

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