Shifting baselines: interdisciplinary perspectives on long-term change perception and memory

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Abstract

Daniel Pauly's concept of the *shifting baseline syndrome* (SBS) focuses on problems of scientists' long-term change perception and in particular on the forgetting of reference points established by preceding generations. Once introduced in the context of fisheries science, the concept is currently widely applied in neighbouring disciplines, but has only begun to enter the field of social and cultural science.

This article considers the *shifting baseline syndrome* in an interdisciplinary context and describes suggestions emerging that way: With regard to the concept's context of origin, it shows that approaches from social and cultural science such as the sociology of knowledge and memory studies allow a more detailed and comprehensive understanding of questions addressed by the concept. Conversely, with regard to social and cultural science, this concept originating from natural science suggests the relevance of autobiographical, communicative, cultural and future memory for studying problems and potentials of sustainability and long-term change perception in general.

Keywords

generational forgetting, generational transmission, long-term change perception, sociology of knowledge, shifting baselines, sustainability, time horizons

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'Dauerten wir unendlich	*'Lasted we infinitely*
So wandelte sich alles	*All would change*
Da wir aber endlich sind	*But since we are finite*
Bleibt vieles beim alten'	*Much remains as of old'*

(Brecht, 1993: 294 [our translation])

1. Introduction

Evaluating long-term changes – for instance the depletion of marine fish stocks – is a problematic task. One factor contributing to the partial or total failure to discern such changes is a generational mechanism of forgetting that impedes the recall of circumstances from farther past, i.e. of circumstances from times beyond biographical experience needed to serve as baselines for measuring long-term change. This is the central point of the shifting baseline syndrome (SBS), a concept conceived by fisheries scientist Daniel Pauly (1995, 2001, 2016; Pauly et al., 2002). His concept aims to explain the short-termism widespread in this field of research and to suggest alternative research designs fit to detect long-term changes. Many marine scientists have adopted the concept, and it has also found its way into the field of social and cultural science (Leggewie and Welzer, 2009: 98, 202; Pauly, 2011; Rost, 2014; Welzer, 2008: 212ff.).

Indeed, the SBS touches upon a set of questions most relevant not only to fisheries science and sustainable fishery alone but also to other fields and disciplines such as the research on climate and global change (Steffen et al., 2015) or to discussions on a recent *short-termism* in historical science (Guldi and Armitage, 2014). Against the backdrop of such references, the present article focuses on rather general aspects inherent to the concept of SBS. The concept coined and mostly applied in the context of natural science will be examined here from a social scientific point of view. This interdisciplinary analysis, on the one hand, intends to show how the SBS touches upon almost classical fields and topics of the sociology of knowledge and memory studies. It demonstrates that both these approaches may help to deepen the understanding of the manifold ways in which baselines shift. On the other hand, by scrutinizing the different elements touched upon by the SBS as it emanated from marine research, this article also aims to point out stimuli for further research on change perception, memory and time horizons.

After the concept and its adaptation have been presented and its elements summarized (ch. 2), in the following we will discuss four particular fields related to approaches of the sociology of knowledge and memory studies that are relevant for long-term change perception (ch. 3), and finally draw some conclusions concerning both a social science based understanding of the SBS and this concept's suggestions for social science research on change perception.

2. The shifting baselines syndrome – a concept originating in fisheries science

2.1. The concept coined by Daniel Pauly

Originally (Pauly, 1995, 2001; Pauly et al., 2002) the SBS was conceived in the context of research on changes in fish stocks and biodiversity. As any observation of change results from comparing a particular phenomenon at different points in time, the SBS focuses on the refer-

ence points from the past serving as baselines for change evaluation: Studies on changes of particular stocks of fish compare the states of these stocks observed at at least two different points in time. Stated simply, a reference point in the past is used as a baseline for evaluating the change that subsequently occurs until a second point in time, for instance the present, is reached. The reference point is the baseline for measuring how much the current state – or states if other reference points are also taken into consideration – differs from that of the past. Obviously such evaluations only account for changes that occur within time spans between the considered reference points. Changes that might have occurred earlier remain out of sight.[1] According to Pauly, exactly this happens in fisheries research on changing ecosystems. Reference points and baselines conducted by researchers remain within the range of these researchers' biographical time horizons and do not reach farther back into the more distant past. Consequently, by limiting their research to rather recent baselines, these researchers fail to notice changes occurring over a longer period.

In short, a first element addressed by the SBS is a preference for research designs limited to the scope of an individual and thus investigating changes occurring during relatively short periods of time, i.e. between points of reference lying within the researchers' personal life-time.

Two further elements are closely linked to this preference for short-termism. If all or most researchers of a particular discipline share the preference for short-termed research designs, in the long run this aggregates into a generational effect. When older scientists leave and are replaced by younger ones, their biography based baselines are forgotten and replaced by the more recent baselines lying within the biographical time horizons of the following generation of researchers. Thus the gradual shift of baselines is closely linked to the generational succession of research personnel (Pauly, 1995: 430).[2]

A figure presented by Pauly (Figure 1) illustrates how knowledge of more remote changes is lost over time, namely if succeeding generations of researchers continue to choose short-term, biography based time horizons when conducting their research on change.[3] Obviously, this is quite a schematic view abstracting from all types of communication, accumulation and documentation of knowledge that constitute science.[4] However, this rather abstract view nonetheless highlights a point relevant to science in general: Forgetting – as it is linked with generational succession and the innovation introduced and established by new generations – is an important mode of change in scientific knowledge.[5] Not only fisheries science but all scien-

[1] Of course, (discontinuous) changes that occurred within such time spans but at times not considered as reference points are missed as well.

[2] In this context, it is important to keep in mind the different meanings the term *generation* has (Mannheim, 1928; Reulecke, 2010). It may refer to age cohorts (persons born in the same period and thus experiencing the same era) or to the generative or familial succession of generations (e.g. grandparents, parents, children). Pauly understands generation in sense of age cohorts – so do we throughout this article.

[3] Such short termism may be also caused by institutional factors such as crises and interruptions in the funding of long-term research (Pauly, 2001: 6).

[4] See, for instance, Robert K. Merton's (1968: 611) remarks on an 'imperative for communication of findings' and 'dependence upon a cultural heritage' – as normative bases of science.

[5] Cf. Thomas S. Kuhn (1970: 151) with reference to Max Planck's observation that new scientific truths are not established by convincing opponents, but because the opponents die out and the new generations become familiar with these new truths from the outset.

tific disciplines have to cope with problems of both the conservation as well as the innovation of scientific findings, sources and data.

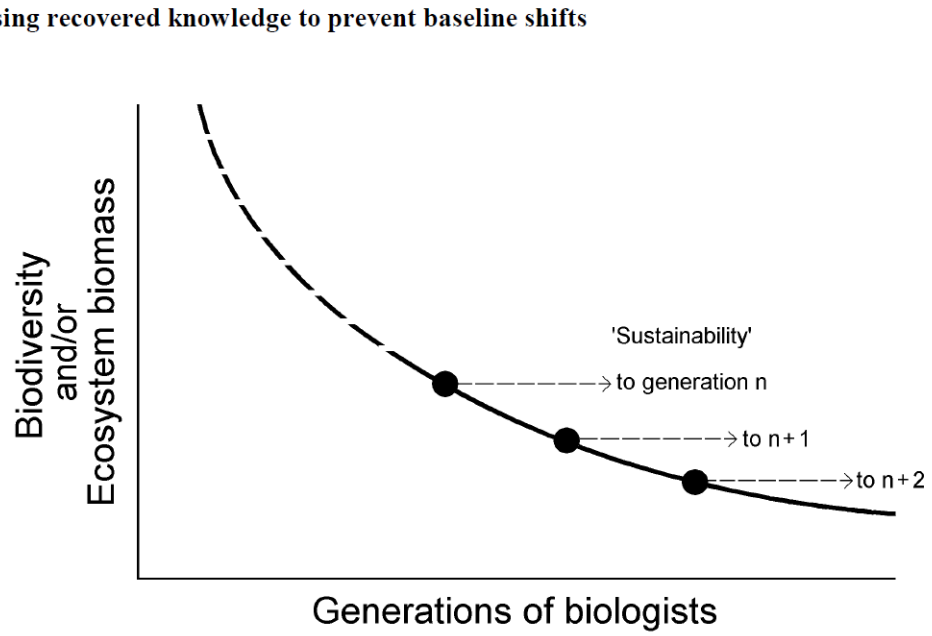

Figure 1. Scheme of shifting baseline syndrome by Pauly (2001: 9)[6]

This takes us to a third element of the SBS central to Pauly's interest. His observation that gradual baseline shifts are related to generational succession does not mean that baselines necessarily shift like that. Criticism of the status quo implies the need to search for alternative research strategies allowing long-term change evaluation and providing valid baselines for sustainability strategies.

Pauly indicates two different ways to extend the time horizons of research on change. The first one, though not explicitly outlined, focuses on more recent research and work. Each generation should adopt and transmit baselines from former generations so that, as illustrated in Figure 1, the baselines of generation n+1 and generation n could still be part of generation n+2's repertoire of change research. In this way, non-reflected biographical short-termism could be prevented by intensifying intergenerational communication between researchers, better documentation and more exchange of change research data. Baselines and data used by preceding scholars could be retained to overcome 'crises' and 'failures in knowledge transmission from one generation of scientists to the next' (Pauly, 2001: 7). However, in this way merely the continuation of baseline shifts could be stopped.

[6] The annotation to this figure reads: 'Human exploitation of newly accessed ecosystems typically implies that the animals that are largest and most valuable (in the nutritive or commercial senses) are taken and depleted first, often with simple methodologies. Smaller, less valuable animals are then the next to be taken, with improved technologies. Early serial depletions of this sort (thick dotted line) are not documented in the literature with the standards now prevailing, and thus often dismissed. Moreover, successive generations of biologists will tend to use the ecosystem state at the start of their career as baseline for what biodiversity and abundances 'ought to be'. This leads to shifting baselines, with each generation aware of less that ought to be sustained. This undermines the concept of sustainability, which becomes generation-specific. Countering this 'shifting baseline syndrome' (Pauly, 1995) requires recovering and synthesizing historic information, i.e. data on earlier ecosystem states' (Pauly, 2001: 9).

The other method to extend the time horizons of change research is the recovery of baselines from the remote past (illustrated by the dotted line in Figure 1). This method corresponds to Pauly's interest in historic data reconstruction and building up complex databases. Recovery and reconstruction of baselines from the farther past, however, includes problems of data availability. Usually the further back in time information is sought, the less is available because in former times data was documented less systematically or even not all. With reference to his own field of fisheries science Pauly proposes considering a wider range of potential sources to compensate for such a lack of data. These include unconventional sources, for instance historical anecdotes, which have already proven useful to other disciplines. In this way it should become possible to recover information on historic fish stocks and to shift back reference points to earlier times to, for instance, times 'before the biomass of major resource species was reduced by industrial fishing' (Pauly, 2001: 8). Thus emerging knowledge on long-term change would provide more valid baselines for ecosystem modelling and sustainability policies.

Pauly, we may summarize, identified several elements contributing to the short-termism of fisheries research on change, and he integrated these elements into a concept that may be considered a theorem. His concept is a proposition on problems related to change perception in fisheries science and beyond.

2.2. Studies on shifting baselines

The SBS as a hypothetical proposition has indeed stimulated much research in fisheries science, marine studies and the broader field of wildlife conservation.[7] Within these contexts the concept's usage developed in several directions.

One point of discussion is the difficulty of finding baselines that provide valid orientation for conservation policies. Ecosystems have been influenced by humans for a very long time. Therefore, authors as Sheppard (1995) regard finding adequate sources for a reconstruction of something like pristine ecological conditions nearly impossible. As a consequence, they consider other strategies to establish baselines, for instance the use of synchronic reference sites from other contexts instead of reconstructing diachronic reference points (Knowlton and Jackson, 2008). Yet another approach defined by historical ecology is taken by Pinnegar and Engelhard (2008) who suggest ways of recovering diachronic information that does not only draw on historical data documented within fisheries but also on other sources such as art, literature or archaeological evidence.

Another point is focused upon by studies investigating empirical evidence of the SBS. Instead of focusing on scientists as Pauly did when coining the concept, they turn to non-scientific ecosystem observers and the reference points they remember – mainly fishermen and the catches and fish stocks they are able to recall. The probably most prominent of these studies by Sáenz-Arroyo et al. (2005) was based on interviews made with three different age cohorts of contemporary fishermen whose memories of species depleted by fishing and best catch ever landed they investigated. Comparing the cohorts of old and young fishers they found that 'old fishers named five times as many species and four times as many fishing sites as once being abundant/productive but now depleted' (Sáenz-Arroyo et al., 2005: 1957). Besides em-

[7] Besides those mentioned below see: Ainsworth et al. (2008), Baum/Myers (2004), Dayton et al. (1998), Jackson et al. (2011), Roberts (2007); also: www.shiftingbaselines.org (accessed 13 February 2018).

pirically proving the existence and rapid development of shifting baselines (cf. also Turvey et al., 2010) these studies extend the field the SBS is applied to. They focus on the non-scientific perception of environmental change. Most of them focus on fishermen, on 'people whose occupations bring them into daily contact with nature' (Sáenz-Arroyo et al., 2005: 1960), a close and regular contact that yet does not prevent them from having rather incomplete perceptions of changes. This direction of research implies that other groups of people and other contexts of nature and society should also be investigated. This is what Harald Welzer (2008: 132) did when applying the SBS in much more general terms to all shifts in perception – and even of values – that occur simultaneously with the change processes in question and thus impede the recognition of that change. Such a broadening of the SBS-concept, however, raises questions on the concept's basic contents and its concise usage.

A third direction in the field of SBS research is of a more conceptual nature. Papworth et al. (2009) thoroughly reflect on some of the aspects of the SBS-concept by applying them to case studies on change perceptions by hunters and a village population and come up with some notable consequences for research designs. In their view, the SBS should not only be assessed as a form of generational amnesia – the failed passing on of experiences from older generations to younger ones. They regard personal amnesia – the forgetting and modification of experiences and baselines during an individual's life course – as a second form of SBS. They also pay much more attention to questions related to perception and (failed) memorizing. Forgetting former states of a changing object may depend not only on problems of the transmission between members of different age cohorts but also on problems of autobiographical memory as they are, for instance, reported in psychological studies on personal change blindness and memory illusions. They also criticize other authors for regarding the SBS as a static anthropological mechanism that automatically causes the loss of baselines of remote periods (Papworth et al., 2009: 94/95; see also Sale, 2011: 161). Instead, they argue in favour of the conception of the SBS as a social phenomenon. As such, the particular forms of intergenerational memory and personal memory (and also environmental change dynamics) have to be regarded as important factors influencing baseline shifts.

2.3. Aspects and sections of change perception

Emerging from methodological issues concerning research on environmental change and strategies for environmental conservation in the field of fisheries science the concept of the SBS refers to a set of questions that are relevant to all kinds of change perception and may therefore be approached from an interdisciplinary vantage point (Campbell et al., 2009: 6). On the one hand, such research could focus on single aspects. A science studies perspective, for instance, could study data transmission practices in different disciplines or their ways of recovering data from historic sources.

On the other hand, the SBS invites a focus on general aspects of change perception. It points at links between collective and individual change perception and their importance for understanding variation in the generation of knowledge on change. The SBS also directs attention to the fact that although baselines are necessary for change perception, they are also available only to a limited degree because to forget or inaccurately recall them is the rule rather than the

exception. Besides, the SBS also allows for a focus on discrepancies between social constructions of reality and real conditions of human life.[8]

In order to analyse such questions, it is helpful to distinguish the different sections of change perception processes involved in the SBS as illustrated by the labels (a) to (d) in Figure 2:

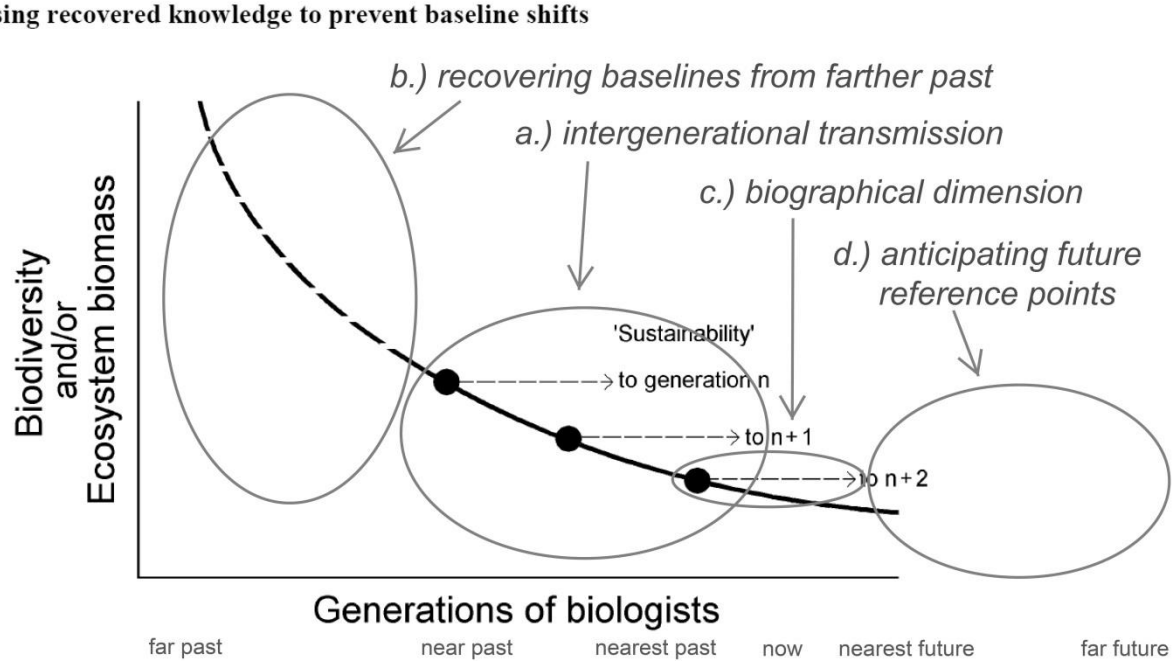

Figure 2. Sections and time references of change perception (our elaboration of Pauly, 2001: 9).

In this figure, the first section (a) captures baseline shifts caused by the generational succession and failed transmission of the former generations' experiences. As regards the linear time line spanning from the far past to the far future, this intergenerational section is located in the near past and covers the time span experienced by the age cohorts alive now or by those that lived in the most recent past. This is the section literature on the SBS scrutinizes most closely.

Shifting back baselines by recovering baselines from farther past is, as section (b) illustrates, a second focus on change perception processes. The assessment of long-term changes requires the reconstruction of baselines from historic periods. For this section, the detection of sources allowing such reconstruction, for instance anecdotes, is of crucial importance.

Particularly the work of Papworth et al. (2009) indicates the third section (c) that Pauly did not address directly: the biographical dimension of change perception. A comprehensive perception of ongoing change processes by persons witnessing them is rather improbable. Instead, the partial or even total modification of perceived change has to be accounted for because it is likely that witnesses partially or even totally forget the observed and may not recall it. This section, on the one hand, is relevant for memory and change perception research as (social-)psychological areas of interest and, on the other hand, requires an analysis of collective frames and discourse that shape individual (autobiographical) memory. Autobiographical

[8] Considering, for instance, dynamics of change processes and their consequences for change perception relates perspectives on the constitution of sociocultural knowledge to those on its material conditions and thus offers a possibility to transcend pure social constructionism, for instance, by critical realism (Murphy, 2007).

memory accounts for processes reaching back from the present into the most recent past and also forward into the nearest future, to the time anticipated in biographical plans and expectations.

Finally, references to a future beyond biographical life expectations constitute one more section (d). Literature on the SBS that is primarily concerned with questions of conservation policies and sustainability – the starting point of all reflection on baselines and baseline shifts – touches upon this only implicitly. However, conservation and sustainability inherently refer to future processes of change and to a type of governance aiming to keep these changes within certain boundaries that have to be determined by making recourse to the experiences of past change processes. Such conservation policies work with projections of possible future states, i.e. they construct reference points in more or less distant futures. In this context, it is relevant to ask whether time horizons are wide enough for providing adequate reference points for coming change as, for instance, the long-term consequences of technological innovation (cf. Jonas, 1984).

The concept of SBS is thus much more multifaceted than it appears at first glance. Baselines and reference points of change perception shift in various contexts and different directions. The concept touches upon a series of aspects hindering the perception of change but also those rendering it possible and broadening time horizons. All these aspects need further investigation to better understand the limits, potentials and dynamics of change perception.

3. Social science perspectives on baselines and reference points of change perception

In order to contribute to a comprehensive understanding of questions raised by the SBS, the following will examine the four sections of change perception processes mentioned above. In a first step, we turn to two social science approaches as a point of departure. The focus is on very general aspects of change perception. Thus, we abstract from differences between change perceptions in particular spheres as, for instance, science or economic activity.

3.1. Sociology of knowledge and memory studies

One of the basic interests of the sociology of knowledge is to understand the constitution of the complex webs of meaning which may be conceived as knowledge (Merton, 1968: 510ff.; Tänzler et al., 2006). Knowledge consists of concepts and schemes shaping the perception of reality and ways of acting which themselves are shaped and modified in processes of perception and acting. In this very broad sense, knowledge is generated, accumulated, modified and differentiated in ongoing processes at both the level of the individual and the social.

A classic foundation of the sociology of knowledge is the work of Alfred Schutz (1967, 1971, 1973, 2011, 2013; Schutz and Luckmann, 1973). His conceptualization of knowledge follows the phenomenological tradition and starts with an analysis of the constitution of experience in the individual consciousness. Experience, in the sense of something being retained in consciousness, can emerge when attention is directed to particular moments in an ongoing stream of consciousness and these moments are made an object of reflection. This stream of consciousness consists of continuous quality impressions. Particular images of already passed quality impressions can be recalled and again be made the object of attention. In this way, recalled quality impressions are transformed into a meaningful and more complex symbolic form: experience in a stricter sense. Thus, time – the ongoing stream of consciousness – and

memory – the reflective capturing of impressions from this ongoing stream and the sedimentation of such experiences into stocks of knowledge – are fundamental elements of this approach. Large parts of Schutz' work focus on reconstructions of individual consciousness and individual acting (Schutz, 1967). Accordingly, Schutz has been criticized for not really considering social interaction, social meaning and social worlds – something his socio-phenomenological approach, however, intended to do (Reckwitz, 2006: 410ff.). Nevertheless, Schutz' writings offer clues and concepts for analysing knowledge in broader and social dimensions: for instance, in his reflections on relevances that are directing attention or by distinguishing ideal types of knowledge as, for instance, the knowledge of experts or that of well-informed citizens which can all be distinguished by different degrees of scope, precision and depth of knowledge.

One aspect common to the socio-phenomenological sociology of knowledge and research on memory is that both disciplines pay attention to fundamental processes of recalling things from the past. Memory studies are an interdisciplinary field of 'neuronal, medical, and psychoanalytical as well as literary, cultural, social, and political studies' (Assmann, 2006: 210). Focusing on individual and collective dimensions of mnemonic practices and products (Olick, 2010: 158), they may be generally understood as being interested in the interplay of present and past, including all its social, mental, cultural and material aspects (Erll and Nünning, 2010: 2).

The object of memory studies is memory in a very broad sense. This includes the whole variety of interplay between the present and the non-present. Storage and recall are two basic elements of memory processes that have to be studied in their subjective (Schacter, 1996) as well as collective (Halbwachs, 1980) dimensions. Of course, memory studies deal – or should deal – not only with successful memorising but also with distorted memory as well as with the failed storage and recall of experiences. Forgetting in its manifold forms is an important and necessary part of memory processes. These forms range from absent-mindedness impeding the encoding of a memory and from the distorted or blocked recall of memories to false memories and memory illusions (Schacter, 1999; Connerton, 2008). Besides the interplay between present and past that between present and future, i.e. the envisioning of the future which – understood in this sense – is a future memory, has recently become an important topic in memory studies (Welzer, 2010). All of these processes of storing, recalling, forgetting and envisioning are highly significant for questions regarding the availability and shifting of the baselines of change perception.

3.2. Reference points in autobiographical memory

As Schutz' phenomenology of the social world starts with reflections on an abstract 'solitary ego', it is appropriate to begin our re-examination of the SBS with a focus on those aspects which are important for an individual's perception of changes it encounters in the course of its own life (section (c) in Figure 2).

Selectivity of attention is a first and most relevant point for questions of change perception because experience in a stricter sense emerges when particular impressions become the object of reflection: Attention is paid to quality impressions of past *nows* that are then recalled from a sphere of retention and made the object of attention in the present *now*. All experiencing is 'coupled with reflection about the experience' (Schutz, 2013: 38). However, acts of reflection need their time. Reflecting about one thing means shifting attention away from the ongoing stream of impressions towards a particular retained thing – and missing other things. Only

those impressions that become an object of attention and reflection change into experiences and thus into something that can be recalled later. The importance of these selections for individual change perception is evident because they explain why the individual's stock of experiences – in our context the stock of potential baselines for change perception – necessarily remains limited.

Selection in attention and reflection takes place for several reasons. First, it can depend on material qualities. Some aspects of the external world are more likely to become impressions of inner duration and objects of reflection than others. Second, since reflection needs time, reflecting on one object means not giving attention to other potential objects. Third, there are different motives for leaving the ongoing stream of duration and switching towards the reflective attitude, for instance actual needs and pragmatic motives. Fourth, selection may be influenced by formerly made experiences that direct attention and shape reflection. Such relevances (Schutz, 2011: 93 ff.) are built up by former experiences that have solidified into types of experience, symbols, and concepts and have become part of meaning structures. These relevances originate from both autobiographical experience and collective history (language, meaning structures). This implies that individual perception also has to be analysed in the context of socially emerging stocks of knowledge and cultural frames (see e.g. Halbwachs, 1980). These causes of selectivity touch upon some very complex questions and cannot be discussed in detail here. However, they permit a basic understanding of the process in which only particular things become a part of individual experience.

The retaining and recalling of experiences are principal objects of memory research. Focussing on the individual, the storage and recall of experiences once personally made may be described as the autobiographical dimension of memory (Markowitsch and Welzer, 2005; Nelson and Fivush, 2006). Grounded in personal life, perceived by one’s own body's senses, and linked with emotions, the experiences entering autobiographical memory are marked by high complexity. The directness of individual experience and the complexity of its contents thus distinguish autobiographical memory from other dimensions of memory that are built up via indirect social transmission. The complex mode of experiencing enhances the memorability of experiences (Welzer, 2005: 150). Compared to other dimensions of memory, the availability of contents of autobiographical memory therefore is relatively high.

However, autobiographical memory is fallible, too. It does not memorize all personal experiences in the same way. On the one hand, there is a general tendency that memories become less accessible with the passage of time. On the other hand, in autobiographical memory there are 'reminiscence bumps' resulting from the enhanced memorizing of experiences made in particular life periods, in particular in the transition period between late adolescence and early adulthood (Schacter, 1996: 298). Such discontinuity of memory has to be taken into account when analysing individual change perception.

The constitution of autobiographical memory is also related to questions of time consciousness. This is one of the points where memory studies and social phenomenology are closely interrelated. Schutz' analysis of experience and meaning constitution includes *inner time* (Schutz, 2013: 198) and a biographical dimension of time experience. This concerns the time consciousness that is constituted by the recollection of autobiographical experiences. Such inner time is made up of relations between personal experiences and thus differs from chronological linear time. In a very similar way, but with reference to episodic memory, Tulving (2002: 5) considers mental time travelling through subjective time and the re-experiencing of

previous experiences as a specifically human capability based on this particular memory system.

Inner time thus is a dimension of time based on the individual's direct experience. Because of these experiences' high complexity that enhances their storage in and recall from memory this inner time is well distinguished from other time dimensions as, for instance, social time. It is, indeed, a subjective dimension of time constituted by periods of particular importance (and voids) and it is marked by linking the biographical past, present and future in particular ways yet always within time horizons closely tied to the relatively short time span of an individual life.

Considering the context of individual experience and autobiographical memory, on the one hand, a relatively high potential of keeping reference points and baselines for change perception can be detected. On the other, several limitations to change perception become apparent: the general selectivity of attention and perception, the loss and distortion of memory, and the narrowness of time horizons.

3.3. Reference points in communicative memory (intergenerational transmission)

In order to perceive change that reaches back into times beyond biographical experience other sources must be tapped. Giving evidence of circumstances that could not have been personally experienced they provide baselines from the more distant past. One type of these sources are the experiences made by near predecessors who witnessed that past. The time span covered by this kind of transmission reaches back from the nearest into the near past (section (a) in Figure 2).

In memory studies, this type of memory is also called *communicative memory* (Assmann, 2006). The widely used concept is highly relevant in order to understand knowledge transmission from elder to younger age cohorts, i.e. to understand the handing down of experiences from one generation to the next, from old to young. Two general aspects should be mentioned here. First, communicative memory refers to a particular form of communication that is mainly linked with everyday interaction and thus not formalized. Secondly, due to its informal character communicative memory ‘has only a limited time depth which normally reaches no farther back than eighty years, the time span of three interacting generations’ (Assmann, 2010: 111). This time span, however, is not absolutely fixed. Communicative memory is subject to historical and societal variation caused, for instance, by particular social frames of communication or different degrees of appreciation for past issues or the past in general. Nonetheless, in the longer term such informally transmitted knowledge fades away.

This fading away of contents of communicative memory corresponds to a phenomenon that Jan Vansina (1985: 24) depicted as a *floating gap* in collective memory in his study on oral tradition and genealogy. His concept focuses on the continuous loss of memories lying beyond the two or three most recent generations whose experiences may at least partly be transmitted via direct communication. Since the memory of experiences fades away then, there is a limit to intergenerational transmission that shifts with generational succession. Vansina relates the depth of memory to time reckoning and he conceptualises time reckoning somewhat similarly to the notion of social time, which is central to time studies in general and part of Schutz' reflections on dimensions of time structures as well (Schutz, 2011: 198; Schutz and Luckmann, 1973: 45ff.).

Summarising some results of the observations on memory related to the time period focused upon here, it seems obvious that intergenerational transmission is a rather basic mode of memory. In this context, questions of change perception have to be discussed by focusing on both the successful and the failed memorising of baselines from the past. This implies that generational baseline shifts – in the sense of forgetting all the preceding generations' baselines – do not happen necessarily.

3.4. Reference points in cultural memory (remote past)

The concepts of memory coined by the Assmanns and Vansina also include references to a past farther back in time (cf. section (b) in Figure 2). Vansina's (1985) research on oral tradition suggests that long-term knowledge – e.g. of kinship genealogies – is either lost or kept in rather abstract and mythological forms devoid of any clear reference in chronological time. The Assmanns' concept of *cultural memory* also relates to knowledge that is not sustained in communicative memory anymore. It focuses on historic knowledge that is retained in a different mode, on knowledge that has been 'exteriorized, objectified, and stored away' (Assmann, 2010: 110). It is knowledge that has already undergone a process of preservation by being selected and separated from its context of origin and that then has been recontextualized or objectified as part of cultural memory. Aleida Assmann (2006: 220) uses the term *archival memory* to indicate a status of latency characterising this form of memory. Being stored in libraries, museums, and archives it can be consulted there and brought back into *active memory*.[9] This has important implications. First, it means that as techniques improving knowledge storage (literacy, press, electronic data processing…) have progressed this has a considerable impact on memory because the capacities of storage and recall are exponentially extended. Second, such archived memory requires increasing expertise in storing and retrieving strategies. This type of memory is not based on diffuse communication but on the ability of specialists to select and organize contents for storage and recall. This relates to Pauly's call for 'using recovered knowledge to prevent baseline shifts' (Pauly, 2001: 9), i.e. to the difficult task of reconstructing information from various kinds of historic traces and to the expertise which is needed to accomplish this task. Third, institutions and rituals play a decisive role in filing particular types of contents and in recalling them periodically to the active memory of wider audiences.

The time spans covered by cultural memory must be regarded as historically variable and as related to social time. Different to inner or individual time, social time refers to shared imaginations of time, to synchronization of social interaction and to positioning interactions and experiences in a shared frame of the past, present and future. With its aspects of time horizons, time organization, or specific time structures of different social spheres, social time is the core subject of sociological time studies (Bergmann, 1983). Norbert Elias' study on the civilizing process, for instance, describes long-term social change as going along with the emergence of a general long-sightedness of orientations and preferences that is also increasingly integrated into the civilized subject's extending self-constraints (Elias, 2000: 379 ff.). At this point Schutz is worth mentioning again since his work suggests that the study of the interlinkage of different dimensions of time experience – subjective/inner time, biological

[9] Both concepts, communicative and cultural memory, correspond to Schutz' (1967: 208/209) distinction of experiencing the past through face-to-face communication with fellow humans or through artifacts, for instance documents or monuments.

time/natural time, and social time/world time – is necessary for understanding time and knowledge formation (Schutz, 2011: 198; Schutz and Luckmann, 1973: 47).

Regarding questions on the recall of baselines in the remote past we may summarize that both concepts of cultural memory and archival memory help to understand the mechanisms and potentials of long-term memory and long-term change perception. They hint at ways in which baselines from the more remote past can be retained and made available to larger or smaller audiences.

3.5. Reference points in future memory

The SBS's inherent aspects take us to a field that has recently become a new focus of memory studies. With its origins in fisheries research on valid bases for conservation policies, the SBS includes a future oriented perspective (section (d) in Figure 2). It consists in the identification of future reference points with limits that should not be exceeded and thus calculates the longer-term effects of present time action. In this way, future developments are sought to be made sustainable. In the end, all research on changes in the distant past and all reflection on valid baselines guided by the SBS-concept aim to project and manage future developments.

Such envisioning of future reference points has to be regarded as a form of memory, too. It is not an envisioning of experiences already made as in case of recalling the past, but an envisioning of things that will or might come. It is an anticipation of experience, an expectation.

This rather broad understanding of memory inherent to the concepts of SBS and sustainable development is not new to the sociology of knowledge. Schutz assumes all actions to have a future-oriented motivation which he calls *in-order-to motive* (Schutz, 1967: 86ff.). Acting takes its motive from a project, 'an act phantasied [sic] in the future perfect tense as already executed' (Schutz, 1967: 87). This projected act is conceived as having already happened in future. Quite similar to the recall of experiences from the past, an already executed act – in this case, however, imagined as having happened in future – is brought to mind in a present moment. Schutz refers to this as the 'future-directed counterpart of recollection' (Schutz, 1967: 58).

In current memory studies, such aspects of future memory receive much attention. There is a new stress on future related memory functions (Welzer, 2010) and on relations between future, present and past that emerge in processes executed by individual and collective memory (Schacter and Welker, 2016).

The extension of time horizons from which baselines can be recalled is one of the SBS's central questions. These time horizons, however, have to be analysed not only with reference to the past but also with reference to the future. This is particularly evident in the context of anthropogenic risks to the environment and natural bases of human life. Increasing technological competencies go along with potential causal effects which only manifest themselves in more and more distant futures with some of them to be experienced by much later generations. Therefore it is important to ask how far present time horizons expand into the future. This also brings to mind that there are two aspects of time horizons worth studying here: on the one hand, the mere range of time they cover, on the other, whether their directions range into the past and/or into the future.

4. Conclusion

This article has examined a concept that Daniel Pauly (1995) coined in the context of natural science when reflecting on problems and obstacles of long-term change research. Our close reading of the conceptions by Pauly and others showed that the shifting baseline syndrome (SBS) may be understood not so much as a syndrome – a group of problems – but rather as an analytic framework encompassing the manifold aspects of change perception: its collective and individual dimensions as well as its references to present, near past, remote past and future as well. Considered as such, the SBS offers more than explanations for (intergenerational) baseline shifts that prevent long-term change perception. Instead, it helps to understand the manifold ways in which baselines and reference points of change assessment shift. Besides the many problems inherent in the acts of memorizing and recalling, there are also ways of successfully recalling baselines from more remote past times and memory practices that can extend time horizons of memory. These are shifts of baselines that support a more adequate evaluation of longer-term change.

Thus the mainly natural science based SBS-research may benefit from insights of memory studies and the sociology of knowledge that help to understand the dynamics, limitations and potentials of change perception. Examining the general constitution of knowledge, for instance, provides a basic idea that the generation of knowledge includes some 'biographical determination' (cf. Schutz, 2011: 189ff.): experiences are made and articulated within biographical contexts. Such biographical framing, on the one hand, to a certain degree explains preferences for short-term perspectives, while, on the other, it does not exclude transcending them by longer-term perspectives. The social science approach also suggests that the questions of future time horizons inherent to the SBS should be made more explicit.

Concerning the social and cultural sciences, a close examination of the SBS suggests modes of a detailed reflection on the many aspects relevant to the perception of long-term changes. Here a broad set of questions for conceptual as well as empirical research emerges. Besides approaching basic aspects of change perception on a very general level – as this article tried to sketch out – subsequent research should follow these up in more detail, e.g. by paying special attention to interrelations between individual and collective processes or by focusing on particular spheres of knowledge such as those of science or economic activity. In this direction, the SBS may incite intensive research on the social and cultural dimension of sustainable development and change perception in general.

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