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PART III THE TIME PERSPECTIVE CONTEXT OF PERSONS WITH SPECIAL NEEDS

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# Time in the Context of Deafness

## Abstract

Hearing impairment is the factor influencing individual experience and development. However, as it influences the identity development, it might also impact the temporal processes. The article analyses the three levels of psychological time in the context of contemporary research. The results are discussed in the frame of particularly crucial factors such as communication, language and culture. Temporal perspective is described in the context of world representation understood as a system of knowledge comprising an individual's beliefs. This system, which plays a regulative role in making choices, building attitudes towards the real world and solving problems, develops as the individual gains experience. However, hearing-impaired adolescents concentrate on the present events more than their hearing peers.

**Keywords:** deafness, time processing, temporal perspective

## Czas w kontekście głuchoty

### Streszczenie

Uszkodzenie słuchu jest istotnym czynnikiem wpływającym na doświadczenie i rozwój jednostki. Może też w sposób znaczący wpływać na proces kształtowania się tożsamości oraz na przebieg procesów temporalnych. Artykuł prezentuje trzy poziomy czasu psychologicznego w świetle współczesnej literatury. Wyniki dyskutowane są w odniesieniu do takich czynników, jak: komunikacja, język, kultura. Perspektywa temporalna została opisana w kontekście reprezentacji świata, rozumianej jako system wiedzy odzwierciedlający indywidualne przekonania jednostki. Jest to system pełniący regulacyjną rolę w procesie podejmowania decyzji, formowania postaw wobec rzeczywistego świata oraz rozwiązywania problemów, a rozwijający się w toku indywidualnego doświadczenia. Młodzież z uszkodzonym słuchem częściej od swoich słyszących rówieśników koncentruje się na bieżących zdarzeniach.

**Słowa kluczowe**: głuchota, procesy temporalne, perspektywa czasu

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## Introduction

The life of every human being, regardless of age and health conditions, is immersed in time. All activities which are undertaken to fulfil human personal needs are related to the chronosystem, which is defined as the pattern of environmental events and transitions over time. It is the chronosystem that includes normative and non-normative events in the context of the timing of events, number of events in a given time, the duration of events, and perceptions of time over time (Bronfenbrenner & Morris, 1998, 2006).

The orientation in chronosystem events requires a few specific psychological time abilities which might be described according to Block (1990) as:

1. Time as succession – reflects the sequential structure of events from which humans perceive (or infer) succession and order of events. It is fundamental to attempt to uncover the preconditions by which humans can make judgements of simultaneity, temporal order, and event succession by invoking sensory and perceptual processes.
2. Time as duration – refers to the temporal (durational) attributes of events, the encoding and retention of such attributes, and their subsequent retrieval upon inquiry. Duration timing, or time estimates, is an important ability that regulates and organizes much of our day-to-day activities, especially when we execute an action and expect a response.
3. Time as temporal perspective (or temporal orientation) – refers to the experiential and conceptual understanding and interpretation of the past, the present and the future, and how they vary across normal and pathological populations. Temporal perspectives can vary within an individual or across individuals due to disease or impairment states (e.g. schizophrenia), pharmacologic interventions, or due to cross-cultural variance (e.g. individual versus collective cultures).

While the above mentioned psychological time conception is coherent, other proposals might be found. Janeslatt et al. (2010) thought that the "time-processing" ability (TPA) might be conceptualized as including the following three subcategories:

1. Time perception – defined as the experience of time; specifically the mental functions related to the subjective experiences of the length and passage of time. It is usually measured by internal time estimation (event time duration);
2. Time orientation – related to the ability to orientate in the passage of time in relation to events taking place in natural and social environments. Time orientation includes three detailed characteristics (Friedman, 1990; Nelson, 2002; Kylen, 1984; Eisler, 2003 in Janeslatt et al., 2010): (a) awareness of the day, date, month and year, to understand our relative location in time ('What day is it today?'), (b) temporal concepts of units such as day and month frequency ("How often?"), (c) sequence (e.g. knowing the temporal order of activities in a morning routine), (d) awareness and understanding of physical time and reading the time on a clock;

3. Time management (TM ) – understood as one executive function related to the ability to identify which tasks to do, plan appropriate time to do them, and the ability to order events and activities in a chronological sequence and allocate appropriate amounts of time to them.

Research by Janeslatt et al. (2010) showed that children with developmental and intellectual disabilities are often reported to have problems in all three aspects of the time-processing ability (TPA). It was found that the time-processing ability development was significantly delayed in many cases of developmental disabilities (e.g. intellectual disability, cerebral palsy, autism) in comparison to typically developing (TD) children at the preschool and school developmental stage. Children with disabilities had the same pattern of TPA as typically developed children, however, at a significantly older age. The result indicates that children with disabilities might mature in TPA at a slower pace, with a larger variance in functioning in TPA within the group than for TD children. The largest difference was obtained in the time management category. This might be related to functional or anatomical impairment of the neural structure (as is the case of developmental disability) localized in the frontal or prefrontal lobe, responsible for behaviour control processes.

In the context of the above mentioned findings related to time-processing ability in cognitive impairment and functional disability, it seems to be crucial to analyse the effect of hearing impairment on time processes. Hearing impairment is the fundamental condition affecting individual development at any level since its beginning, so it might also influence the time-processing ability. The hearing impairment outcomes and results might be differentiated, however, because the deaf population is extremely heterogeneous with respect to individual characteristics, the type of hearing loss (conductive versus sensorineural or mixed), deafness aetiology (congenital versus acquired), the onset (prelingual hearing loss (before the process of speech system development is finished in its basic fundaments) vs. perilingual hearing loss (during the process speech system development) vs. postlingual hearing loss (after the development of the improved ability to communicate verbally), severity of hearing loss, and social developmental experience within the family context (native signers versus late signers).

## Deafness as the particular developmental factor of time experiencing

Deafness is a special context of development, considering the occurrence of very unique developmental situations. The impact of deafness may be analysed both in the broad, as well as in the narrow context. The broad context is revealed when development is analysed from the perspective of understanding the process of developmental system adaptation in a situation of sensory deprivation, brought on by hearing impairment. The narrow context is adopting deafness from the individual, single, personal human perspective, experienced as a particular situation in which cultural and linguistic traditions provide the deaf person with

a unique developmental richness, contributing to the diverse formation of temporal information processing. Deafness presented both in the broad and the narrow context might be a factor modifying the course of development of multiple processes and phenomena connected with time reference, as a physical and social dimension of the life environment.

Deafness has historically been viewed as a physical impairment associated with functional disability, and losing one type of sensory information at specific developmental times may lead to deficits across all sensory perception systems with widespread cognitive and perceptual breakdown.[2] Referring to H. R. Myklebust (1964) – a pioneer of the psychology of the deaf – it may be stated that the lack of reception of auditory sensations significantly modifies the hierarchic process of cognitive development achieved by gradual attainment of more complex activities; from sensual reception to the formation of a complex perception process, attention, learning, memory processes, up to the level of abstraction. This author suggests that the lack of an auditory channel in deaf people alters their perception. This generalised-deficiency hypothesis proposed that an auditory deficit may affect the neurological development and organization of other perceptual systems so that total reactivity of the organism is affected. There is some contemporary evidence to support this hypothesis because sound provides an "auditory scaffolding" for time and serial order behaviour, which seems to be fundamental for all mental and pragmatic activities. When there is the lack of auditory stimulation, auditory scaffolding is absent, resulting in neural reorganization and disturbance to cognitive sequencing abilities (Conway et al., 2009). However, the basic consequence of hearing impairment is the reduction of verbal language development possibilities, both considering generating and understanding speech, and in connection with the mediation function of speech; complex processes of logical thinking in deaf children develop in a specific way. Still, the great variety of hearing impairment causes and diverse scope of developmental changes following from that impairment must be emphasised. Congenital deafness is related to the loss of hearing present at birth or the loss that may develop later, but is due to genetic causes or other influences that affected the fetus while it was in the uterus (in the womb). It is fundamental that individuals with pre-lingual hearing impairment differ from post-lingual in their psychological functioning, but there is also an environmental factor such as a family mode of communication according to parental hearing status.

[2] This is the background of the medical model of deafness which focuses on the aetiology of hearing disorder and its impact to individual life. The other concept is the socio-cultural deafness model which states that a hearing impaired person is the member of a linguistic and cultural minority due to sign language usage. According to this model the Deaf community uses the term of "Deaf" (in opposition to "deaf") to delineate their separateness from the community that communicates orally (Lane, 2000). Deaf children of Deaf parents are Native Signers because of early access to sign language, but deaf children of hearing parents are late signers because they usually get access to sign language at school. This extension is fundamental for communication skills development.

So does the limited ability to receive sounds and understand verbal messages significantly influence the ability to experience time? Let us try to analyse this issue on the basis of the most recent research results.

Temporal perception comprises subjective phenomena such as simultaneity, successiveness, temporal order, subjective present, temporal continuity, and subjective duration. According to the hierarchical model proposed by Pöppel (1997), at the fundamental level, identification of basic events and successiveness are provided by the mechanism implemented by neuronal oscillations of functional system states with a duration of 30 ms. At the next level, time tags are responsible for sequential representation of several events. Memorising and then reproducing from memory events as successive is possible due to the fact that they are coded simultaneously with data referring to the time of their occurrence. Events may be temporally tagged (encoding of temporal content) and re-ordered in the elaboration of a percept and the subjective appreciation of its temporality. At the third level, the automatic and pre-semantic mechanism of temporal integration binds successive single events into one complex perceptual unit of a 3 s duration, which is also operative in movement control and other cognitive activities.

Time properties of objects and events such as temporal synchrony, rhythm, tempo, and duration seem to be amodal (Bahrick, 2009) and might be independent of the auditory deprivation. However, a typical sensory development, as well as specific language impairment or delay related to it, may affect different aspects of time experiencing. Processing in deaf children seems to be deprived of their direct experience within the physical and social context, as well as input from others which is essential in the development of time conceptualization and understanding in children.

The study outcomes will be analysed due to fundamental assumptions:

Firstly, time perception – one of the most important audio stimuli parameters is duration of events, so the hearing impairment might be followed by the reorganisation of time experiencing at the fundamental level (neuronal and perceptual).

Secondly, time orientation – the time experience focuses on the awareness of the time periods and understanding their relative location in time with the cognitive ability of naming those time categories and ordering them in the context of time line. The development of time concept understanding as reverse to sequential time, defined as one in which the numbers form a naturally growing sequence (Piaget, 2011), might be disturbed by hearing impairment.

And thirdly, the pattern of environmental events and their transitions over time – which includes the individual time perspective and might be affected by hearing impairment.

Although there is only limited research done in this field, the revision of the results is presented to find the final conclusion about the influence of hearing impairment on psychological time in the deaf.

## High- and low-frequency temporal processing in the deaf

The problem of time perception seems to be interesting and of high importance, but the results are confusing and dependent on many crucial factors: experimental procedure, temporal characteristics, level and time of hearing impairment.

Results of experimental research that measure the fundamental high-frequency processing level identification of basic events successiveness within the duration of 30 ms may be divided into three groups.

Firstly, there is some evidence to argue that deaf persons, in comparison to hearing ones, obtained poorer temporal processing capacity when the auditory modality surpasses the visual one in detection of temporal change. They also need a longer interval between two stimuli to detect them, and also have difficulties with the perception of temporal order (Levine, 1958; Blair, 1957; Hanson, 1982; Withrow, 1968 in Poizner & Tallal, 1987). What is interesting, the Morse code perception is five times faster with an auditory than with a visual signal (Henneman & Long, 1954 in Poizner & Tallal, 1987).

Investigating tactile and visual temporal processing by means of a simultaneity judgement task, Heming & Brown (2005) showed that perceptual thresholds were significantly higher for the deaf group than for the controls. This study with adults who suffered from early hearing loss suggests that an impairment of temporal processing follows early deafness in the profoundly deaf compared to hearing controls.

Secondly, there is some evidence that there are no differences between the deaf and hearing in time processing. Other studies (Bross, Sauerwein, 1980 in: Poizner & Tallal, 1987) showed similar performance between deaf participants and controls. However, when visual perception was absorbed, no significant differences between the deaf and control groups were obtained. In an experiment presenting a series of flashes examining temporal processing in profoundly deaf individuals in the range of milliseconds, no differences were found in the processing of rapidly changing visual stimuli between congenitally deaf and normally hearing adults; that is in temporal processing at the high-frequency level to detect the stimuli as non-simultaneous.

Poizner and Tallal (1987) tested congenitally deaf signers in four experiments comparing rapid temporal analysis at the three different levels of information process complexity: sensation, perception and memory. The research showed that hearing impairment did not affect the significant difference between deaf and hearing adults in any of the three measured aspects of time information processes. There were no differences in the critical flicker frequency thresholds nor the two-point discrimination (two-point threshold). Perception of the temporal order as combination of two stimuli, as well as combination of stimuli triplets, was not significantly affected by the group effect. The same result was found in serial memory with a long fixed interstimulus interval (ISI).

The analysed results conclude that deaf individuals did not show any deficits in the perception of simultaneity versus non-simultaneity, nor in the perception of temporal order. These results may indicate that in different kinds of visual tasks,

the acuity of temporal resolution may be similar in deaf and in hearing individuals. Similar results were found by Mioni et al. (2012), who concluded that deaf adults performed as accurately as controls in the time reproduction and the time production of visual stimuli when engaged with short durations (milliseconds). Deaf adults were more accurate than controls when tested with the time production task with long durations (3, 4 and 5 s) and with the time discrimination task.

Finally, there is some evidence to argue that deaf persons, in comparison to hearing ones, obtained better results because of sensory compensation for the lack of auditory input (Neville et al., 1983; Neville, 1984; Bross & Zubec, 1975; Bross, Harper & Sicz, 1980 in Poizner & Tallal, 1987). Deaf native signers show enhanced temporal processing of visual stimuli, due to the auditory cortex subserving visual functions. They also show enhanced detection of movement in peripheral visual fields. It was also found that the visual temporal resolving power measured by critical flicker frequency thresholds was progressively enhanced, even in hearing individuals with short-term auditory deprivation. Native signers are born in a deaf family and are brought up in the sign language context. They are generally involved in bilingual education with sign language as the mother tongue and the national language as a foreign one.

Elena Nava and colleagues (2008) in tricky experiments found that the deaf group did not differ in temporal order thresholds and points of subjective simultaneity for the two visual stimuli, however discrimination responses were faster in deaf individuals than in hearing controls, especially when the two stimuli appeared at peripheral locations. This result of fluent performance in deaf participants is explained by the authors as by higher attentional resources in visual space, which are fundamental for fluent communication in sign language.

At the fundamental level of temporal processing abilities in the millisecond range, identification of basic events and successiveness is provided by a mechanism implemented by the neuronal oscillations of the functional system, which might be impairment, as well as a factor differentiating results.

Due to that special characteristic of high-frequency temporal processing presented by the deaf group, it might be also expected that a similar pattern will be present at the low-frequency (3-second duration) level of temporal integration of successive single events into one complex perceptual.

Although confusing evidence might be expressed in the field of time perception of high-frequency changes, the results of deaf perception of low-frequency changes in the range of seconds are more coherent. The findings by Kowalska and Szeląg (2006) presented that congenitally deaf adolescents found the accuracy of interval duration judgement difficult. Independently of the experimental task and in comparison with hearing peers, deaf adolescents judged accurately intervals of around 3 s, as well as overestimated standards shorter than 2 s and underestimated those above 3 s.

A similar pattern of time processing was found by Tirinell et al. (2009) in an experiment when participants had to listen to the auditory pattern of the conga

timbre and/or to feel the pattern haptically and reproduce its overall duration. This was done by pressing a button in order to mark the start and end of an equal time interval. This experiment confirmed that there was a difference between the hearing and the deaf in time reproduction variability, but no difference in accuracy. Reproductions of congenital deaf adults showed a greater variability in judging the duration of the structure events. Independently of the hearing status, however, regular patterns improved accurate reproductions more than irregular ones; a single item counting strategy was used rather than a multiple one. Sharing attention between temporal and non-temporal information reduces accuracy in the time reproduction task in both deaf and control groups. Completing specific tasks by deaf subjects was combined with a global underestimation of the duration of events. This was found in both hearing and deaf subjects, this is a typical influence of an individual's expectation, it is not a specific pattern of time processing related to deafness.

Nowadays, cochlear implants seem to be a good remedy for developmental problems of deaf people. What might be the cochlear implants' effect on time perception? Research in adults with cochlear implants as a result of post-traumatic deafness (Szeląg et al., 2004) indicates that there is a reduced capacity for temporal integration in the tested group. This study showed that even after implantation done in adulthood, when speech memory might be the background for audition stimuli, temporal integration was poorer particularly for lower metronome frequencies, in comparison to normally hearing. These observations point to deficits in auditory comprehension after cochlear implantation and to a specific temporal processing delay. Even short lasting auditory deprivation, however supported with the cochlear implant, seems to reduce low-frequency (2–3 second range) domain of stimulus in adolescents with post-lingual deafness.

While auditory perception seems to be appropriate for time processes, still a close relationship between temporal information processing within auditory stimulation (TIP) and speech might be found. Both temporal ranges of auditory stimulus appear to be fundamental for verbal language. Firstly, a high-frequency level of a microseconds range (30 ms) is related to single units of language-phonemes, and secondly a low-frequency domain of a second range (2–3 s) is related to phrases of words production and understanding. In comparison, sign language, which was first described by Stokoe in the 1960, seems to engage mainly the low-frequency level of visual stimulation because it engages a lot of manual characteristics; not only the number of hand shapes used, but also the movements the hands can make and the positions in which signs can be made. On the other hand, non-manual characteristics (e.g. movements of the face, eyes, eyebrows, cheeks, mouth and forehead, the head, and/or body) are also important components of all sign languages: grammar, and/or lexicon, as it was previously analysed in the Polish Sign Language (Tomaszewski, 2010). Native signers seem to compensate auditory deprivation by improving the accuracy of detecting visual stimuli in the peripheral visual field.

## Time conceptualization and understanding in the deaf

However, although hearing impairment affects the accuracy of duration judgement, the effect might be differentiated and difficult to control. At the upper level it is also possible to divide the question of time into two complementary concepts: (1) sequential time, which is defined in a range of days, weeks, months and years with regard to these ranges order in sequence, as an order of events, or as a relation of the type 'now', 'earlier', 'later'; (2) the development of concepts of time, that is, an abstract mental process involving reasoning.

The process of time concept development is gradual and transmitted by language skills and it occurs only after acquisition of the concept of space (Stokoe, 2001). In deaf children, however, the abstract thinking component of deaf intellectual structure appears later than that of hearing peers (Zwiebel & Mertens, 1985). In deaf children, the understanding of time and related concepts might be inadequate, incomplete and often virtually non-existent.

Many studies give evidence for the hypothesis on the developmental difficulties in time understanding that are affected by deafness (Robert & Jay, 1975; Kaiser-Grodecka & Cieszyńska, 1991; Eden, 2008), however sequential time perception might be also stimulated and enhanced by using specific teaching procedures (Ingber & Eden, 2011), the effects of which are moderated by three factors: 1) early diagnosis and early intervention for deaf and hard of hearing, 2) hearing loss aetiology (the type of hearing device a child used); the child with cochlear implants showed greater improvement.

Robert and Jay (1975) conducted experiments in which deaf and hearing subjects decided the temporal order of events in picture series and in sentences. Deaf children aged 8 and 11 years performed similarly to hearing peers on a nonverbal picture task. Children from both groups identified the left-hand picture as starting the sequence and the right-hand picture as finishing the sequence. They also described most picture series in the natural left-to-right order in which they were shown. The verbal task was much more difficult for the deaf because of their delay in linguistic skills. This delay results in the general use of a sequence of simple sentences to describe the events shown in a picture series, and a response to most multiple-clause sentences presented as though the events being described had occurred in the order they were mentioned.

In Kaiser-Grodecka and Cieszyńska's (1991) research done in Poland in the late 80s' it was found that adolescents aged 12 to 15 faced difficulties in time event ordering at two separate levels. The primary time level, related to personal individual experiences, is the fundamental base for development of structures of historical secondary time. These time dimensions might be interpreted in categories of the bio-ecological developmental model where time is constituted at three levels: micro-time refers to specific episodes of proximal processes, meso-time refers to the events occurring in the person's environment, such as over the course of days, weeks or years, and macro-time focuses on the shifting episodes

occurring in wider culture and historical perspective (Bronfenbrenner & Morris, 2006). The results were coherent to Eden's results (2008), even if sustaining to the elder population, 6–10-year-old children with hearing impairments experienced very significant difficulty arranging pictures in temporal order to produce a story. Language seems to be involved in acquiring temporal concepts in deaf children. The stages at which children acquired concepts of clock, calendar, historical time, and chronology are affected by language acquisition (Senior, 1988; Bylholt, 1997). However, it must be pointed out that deaf native signers have no developmental delay in the assessed function; in other cases the reasoning powers of the deaf and hard-of-hearing are stunted. The problem is what language is their mother tongue. Any language development deficit makes the learning of time concepts even more difficult. Deaf children of hearing families have limited exposure to conversational situations. Without hearing, the deaf children are deprived of direct experience with the environment and input from others, which is essential in the development of concepts of time in children.

## Temporal perspective in the deaf

Temporal perspective is a fundamental process in both individual and societal functioning (Zimbardo & Boyd, 1999; Zimbardo & Boyd, 2008/2011). It is defined as a non-conscious process in which temporal categories (past, present, future) play a leading-connective role in the relationship between personal and social experiences. These categories help us give meaning and order to everyday life events. Temporal cognitive frames are the core background for encoding, storing and recalling personal and societal events, as well as for building personal expectations, goals and imaginative views. Individual time perspective is a learned frame for many human cognitive processes as judgement, decision and actions.

Based on Zimbardo's temporal perspective theory, it might be assumed that deafness, understood as a culture – an idea that has recently emerged and considers deafness as a personal trait and not a disability (Lane, 1997), creates a specific context for temporal perspective learning process. Deaf people belong to the Deaf Culture, which according to Brislin's (1990) definition, refers to the widely shared ideals, values, formation and uses of categories, assumptions about life, and goal-directed activities that become unconsciously or subconsciously accepted as 'right' and 'correct' by deaf people, who identify themselves as members of a sign language minority group.

Within the Deaf Culture, the time orientation is polychromatic and more focused on the past or the present in relation to the hearing one (Mindess, 1999 in Slife, 2007). Polychromatic orientation means more contextual orientation towards time that takes in multiple reference points from the past, present and future. Stories that are told are carriers of history, ways of repeating and reformulating the past for the present (Padden & Humphries, 1988). There is awareness of time and schedules within the deaf community, but there is a difference in the degree of importance of

the schedule in comparison to the hearing one. People in the field of deafness or the deaf community often refer to "Deaf Time": meaning that deaf people do not start events "on time". This may be because deaf people put more emphasis on people and relationships than on clock time. If a meeting is scheduled to start at 8:00, people may arrive and greet each other at that time, but often the formal meeting does not start until 8:30 (Padden, 1980).

Comprehensive studies of Deaf Culture were done in an American minority, so it was interesting to find out if the temporal perspective conclusions were universal and present in Polish hearing impaired adolescents. In Kossewska's (2012) research, deaf adolescents aged between 15 and 17 were compared to controls. The testing method applied was the so-called "Map of My World", used to assess general cognitive structures of individuals. It did not only allow the learning of the perception of various constructs, but also the assess elements that a person uses to construct their representation of the world. Cognitive representation of the world was described in categories proposed by Gurycka (1994), among which the most important to previous research was time orientation. Each subject was shown a set of signs and symbols and asked to use them to draw their world on a clean sheet of paper. Subjects were asked to include in their picture all significant objects, persons, ideas, objectives and values, their own relation towards each of them and relations between the elements. Maps were analysed both from the quantitative and qualitative points of view. Quantitative analysis is the first stage that allows us to find elements characteristic of specific types of representations, such as temporal perspective. The results show that deaf adolescents present significantly fewer time categories in their world representation than the hearing ones do. They are usually related to present real objects, such as school, peer and family relationships, and dating. The world of hearing adolescents includes more future time perspectives which are related to both vocational, as well as social and personal goals.

The results gained in Polish deaf adolescents might be reflected by specific social and educational contexts. Time perception of the low-frequency changes pattern described by Kowalska and Szeląg (2006) might reflect disruption in the judgement process related to congenital deafness, however, it might be also affected by environmental factors. It is fundamental to point out the existing model of deaf children education in Poland which is incomparable to bilingual education (Grosjean, 2001). The assumption of education and therapy model in Poland is that oral speech should be the primary mode of communication in deaf children. The subjects reported the use of both modes of communication – sign language as well as speech – in both environments (in school and at home). Polish deaf adolescents used to be diagnosed relatively late, so neither the output of speech therapy nor sign language communication skills might be satisfactory if they did not develop in the deaf family context.

Polish deaf adolescents attend segregated schools and usually live in a dormitory outside their family. Social life and realisation of interests have moved out of the family. For deaf and hard of hearing youths, institutions of the real world perform

complex functions: socialisation, education and upbringing. Institutions create a controlled environment where young people may develop and satisfy their needs. They give them a chance to realise the need of influence, which is very important in the development of a mature, responsible personality. Present time perspective may limit the range of deaf adolescents' judgements, decisions and actions. Only few deaf youths in the research by Kossewska (2012) pointed out extended education and profession as important values and goals within the future context, while according to Zimbardo and Boyd (1999), a more future-based time perspective could help students study and progress to higher education. Adolescents in general, however deaf teenagers specially, experience negative feelings living in relatively less secure environments, which may be followed by present oriented behavioural strategies that reflect an orientation towards immediate outcomes and little concern for future consequences.

This finding may result from the fact that the deaf population is very heterogenous – 95% of deaf children are born to the hearing (Mitchell & Karchmer, 2004), and these children may not have received any usable language input during critical language acquisition periods of brain development. Lacking language input during a child's earliest years and the underdevelopment of a formal language system can result in an adult without fluency or competence in any language, including sign language (Sacks, 1989). A hearing family usually creates the low-stimulating developmental environment. Possession of a language system, either verbal or sign, is necessary to facilitate abstract thinking, mature personality development and future goal orientation. Without such a system, some deaf persons may suffer from the lack of ability to think abstractly or to generalize concepts. The development of future time perspective might be also limited by the low level of verbal communication skills.

Temporal perspective is linked to health problems in the general population. Many studies found more mental health problems among hard of hearing and deaf adults than in the general population. It was demonstrated that the greater the degree of hearing loss, the more mental health problems experienced (e.g. Tambs, 2004). The higher amount of mental health disorders, such as depression, might be related to the low level of future time perspective in deaf persons because this sort of temporal organisation is usually related to low subjective well-being and a higher level of depression in the general population as well (Coudin & Lima, 2011). Mental health problems might be more complex and serious when there are common impacts of many developmental factors, such as lack of safety and low communication – all a lack of fulfilment of psychological personal needs.

## Conclusions

Hearing impairment seems to affect time information processes as well as temporal perspective development. The following general statements might be formed in reference to analysed research, however, there is no found fundamental

differentiation between Native and Late signers which might be due to linguistic access and early mental development. In deaf perception, the external stimulation is reduced mainly to one exteroceptive receptor within the visual modality. Time duration perception is differentiated in reference to the perceptual unit duration, as well as the perceptual mode, however the process of compensation might be observed in the threshold of visible stimuli. Focusing attention on direct visual perception and a significantly lowered capacity of receiving simultaneous auditory stimuli, the sensual modality leads to difficulties in the scope of sequencing events in time. Limited access to social and communication exchange within episodes of mutual engagement may cause an asynchronism in the time flow of event reception, and as a further consequence, difficulties in the formation of language time concepts. Time is an abstract concept, so conceptualization and understanding may be made difficult both in the dimension of ordering personal events and constructing primary time concepts, as well as historic events, due to the limited access to secondary time concepts. The range of experienced events limited to visual space influences the subjective feeling of time flow and the domination of present temporal perspective.

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