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Subjective Evidence Based Ethnography: Method and Applications

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Abstract

Subjective Evidence Based Ethnography (SEBE) is a method designed to access subjective experience. It uses First Person Perspective (FPP) digital recordings as a basis for analytic Replay Interviews (RIW) with the participants. This triggers their memory and enables a detailed step by step understanding of activity: goals, subgoals, determinants of actions, decision-making processes, etc. This paper describes the technique and two applications.
First, the analysis of professional practices for know-how transferring purposes in industry is illustrated with the analysis of nuclear power-plant operators' gestures. This shows how SEBE enables modelling activity, describing good and bad practices, risky situations, and expert tacit knowledge.
Second, the analysis of full days lived by Polish mothers taking care of their children is described, with a specific focus on how they manage their eating and drinking. This research has been done on a sub-sample of a large scale intervention designed to increase plain water drinking vs sweet beverages. It illustrates the interest of SEBE as an exploratory technique in complement to other more classic approaches such as questionnaires and behavioural diaries. It provides the detailed "how" of the effects that are measured at aggregate level by other techniques.

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1 Subjective Evidence Based Ethnography (SEBE): a tool for accessing subjective experience

1.1 What is SEBE?

SEBE is a technique to collect subjective experience. Behaviour of a person has two aspects. One is overt and observable from the outside: motor actions and speech are the main components, but also stimuli in the environment we interact with, which are part and parcel of

actions. The second is “covert behaviour”: emotions, goals, motivations, interpretation, intentions and more generally psychological processes which cannot be accessed without the collaboration of the person.

Behaviour is what a person actually does. But this results from what the person intended to do and the conditions provided by the environment. To truly understand “what happened” we should know the person’s perspective, her/his motivations and goals, how s/he perceived the situation and how/why the final observed result occurred. For example, the fact that I ride the bus may be an account of my overt behaviour, but from my perspective, what is psychologically important is that I am going to a job interview – the fact that I take the bus rather than the metro is just a matter of local transport availability. If I get stressed as the bus is stopped in a traffic jam, this can only be fully understood from the perspective of my goal to get the job and of the consequences of being late in my culture. So we must study *activity*, which includes overt and covert behaviour, and the context.

Subjective Evidence Based Ethnography (SEBE) captures the overt behaviour through first-person perspective (FPP) video recording provided by miniature cameras, called “subcams” (subjective camera: Lahlou, 1999), worn at eye-level by the participants; the mental states are reconstructed by the participants in a “Replay Interview” (RIW) where they watch their own tape and explain. Historically, SEBE is a technique designed to analyse work environments in natural experiments and support action research (Lahlou, Nosulenko, & Samoylenko, 2012; Lahlou, 1999, 2009). It is especially fit for ecological psychology (Barker, 1968; Gibson, 1982; Greeno, 1994; Kaplan, Hooper, & Gurven, 2009; Uexküll, 2010) because it captures the context of situations and its impact on individual behaviour. It also enables to study goal-directed activity (Cranach, Mächler, Steiner, Eiser, & Scherer, 1985; Leont’ev, 1978) because it empowers the individuals to remember their motives at the time of action and reconstruct their mental processes. Enabling such reconstruction processes must include providing the subject with contextual cues, since natural activity emerges in context as a series of situated actions (Suchman, 1987) where cognition and actions are the product of a co-construction using elements distributed in the context (Hollan, Hutchins, & Kirsh, 2002; Hutchins, 1995; Lave, 1988b).

SEBE is a form of digital ethnography in that, in order to understand participants’ life in their personal and cultural perspective, it gets data in the field and from discussions with “native” participants themselves. As in classic ethnography, the researcher must have some first-hand knowledge of the field to be able to communicate effectively with informants, to understand what constructs they refer to and therefore to share to some degree their own “emic” perspective (in the participant’s own terms) (Headland, Pike, & Harris, 1990; Headland, 1990; Jahoda, 1977; Young, 2005). SEBE is specific in that, in the RIW, SEBE confronts emic (informant’s) and etic (researcher’s) perspectives to find a description that is acceptable in both based on the display of shared evidence (the subcam film) - see (Lahlou, 2011a) for a detailed discussion of this crossing of perspectives. SEBE differs from *autoethnography* in that the researcher does not need to be the informant (the biographer), and differs from *insider ethnography* in that the researcher does not need to be a member of the community studied. It is close to *person-centred ethnography* in that it does focus more on the informant’s own experience rather than asking her/him to explain the behaviour of other members of the community. Moreover, the standard ethical protocol of SEBE implies that participants have a look at the images that would be published and intensely contribute to the interpretation of collected data. Therefore, the participant is considered as a research collaborator rather than as a subject, e.g. be given the choice of staying anonymous or being credited. Hence our use of the term “participant”, in the spirit of “cooperative observation” (Lahlou, 2006).

Because this method was developed in close collaboration with researchers from the Russian Academy of Science who are the intellectual heirs of Lomov (Nosulenko & Rabardel, 2007;

Nosulenko & Samoylenko, 2009), Russian Activity Theory heavily influenced the processes of data collection and analysis; but in practice that framework - and specifically one adapted from (Leont'ev, 1978) - mostly serves to elicit goals and sub-goals in the discussions with the participants and to cut the flow of data into analytic chunks as illustrated in section 2.2 below. The situated and distributed cognition frameworks (Hutchins, 1995; Lave, 1988a; Suchman, 1987) were also important influences. As a result of these hybrid influences, SEBE is a bottom-up, empirical family of techniques which does not claim for a single philosophical or epistemological background (e.g. about how "real", "social", "cultural" or "constructed" are the phenomena it studies). In practice, SEBE is used by researchers with very diverse beliefs in these domains.

Data collection technique with SEBE

Various research teams that were confronted to the need of in-depth activity analysis and dared to use video at a time it was still a heavy technique came more or less independently with their own mix and developed or adapted self-confrontation techniques: self-confrontation (Cranach & Kalbermatten, 1982; Theureau, 1992); explicitation interviewing (Vermersch, 1990); crossed self-confrontation teaching (Clot, Faïta, Fernandez, & Scheller, 2001). Video became a tool in many action-researches that were conducted in an academic context. For example, in studying teaching (Engeström, 2004; Goldman, Pea, Barron, & Derry, 2007). Strangely enough, the development was faster in ergonomics and psychology than in ethnography. First person perspective capture, pioneered by Steve Mann (Mann, 1998) brings a great improvement to these techniques, and was also put to use early by the La Trobe team (Omodei, Wearing, & McLennan, 1997, 2002), and more recently in sport psychology (Rix & Biache, 2004). Furthermore, publications based on the use of the SenseCam, a time-lapse medallion camera capturing first-person view (Hodges et al., 2006), are multiplying (see other papers in this issue); but while footage provided by the SenseCam are excellent to count occurrences of specific events, they hardly provide the detailed insights enabled by motion films. A whole book would not suffice to describe every technique in detail (for a detailed comparison see Le Bellu, 2011 and Rieken, 2013). Teams tend to specify their techniques in great detail, partly for reproducibility and transmission, partly to claim novelty and specificity in publication. In its purpose of accessing the participant's cognition, SEBE is of course similar to other techniques of investigation using video and confrontation interviews. Its specificity lies (1) in that it uses first-person perspective recordings and that, (2) in the collection process, the participant is given a status of collaborator rather than of a subject. Our practice with SEBE is to consider it as a basic toolbox (first-person collection + replay interview) that should be adapted to each specific topic; therefore the collection and analysis will vary to some degree.

a) Collection of overt behaviour

Participants wear at eye-level, on a pair of glasses or other support (bandana, helmet…) light and discrete miniature video-cameras called subcams (Lahlou, 1999) which transparently record what they do as they act. Subcams provide a first-person perspective recording of the visual array (wide-angle, High-Definition), sound (especially speech), actions performed with the hands, but also a good sense of motion and attention focus, and to some extent emotional cues such as breathing, voice tone, or fine hand movements. Furthermore, films provided by the subcam, so-called "subfilms", differ radically from classic film, even from the cinema "subjective view". They induce in the viewer a state of fascination and immersion comparable to what Csikszentmihalyi (Csikszentmihalyi, 1988) calls the state of "flow", with full capture of attention and loss of self-consciousness. Those subfilms contribute to empower insight in analysis of human activity and make the "replay interviews" (see below) much richer.

Thus, the subcam is an outstanding tool to capture situated action (Suchman, 1987). We still have to assemble our own devices to get a very small and handy device with a day-long autonomy, and a form factor that can accommodate all actions and professions without getting in the way, e.g. for doctors, nurses, barmen, nuclear plant operators, or policemen (see Figure 1:). The recent design of wearable video capture commercial products (e.g. "Go Pro" or "Google glass") should provide considerable development to our technique as soon as these off-the-shelf products will have overcome their current limitations for ethnographic capture (for detailed specifications, see Lahlou, 2011a).

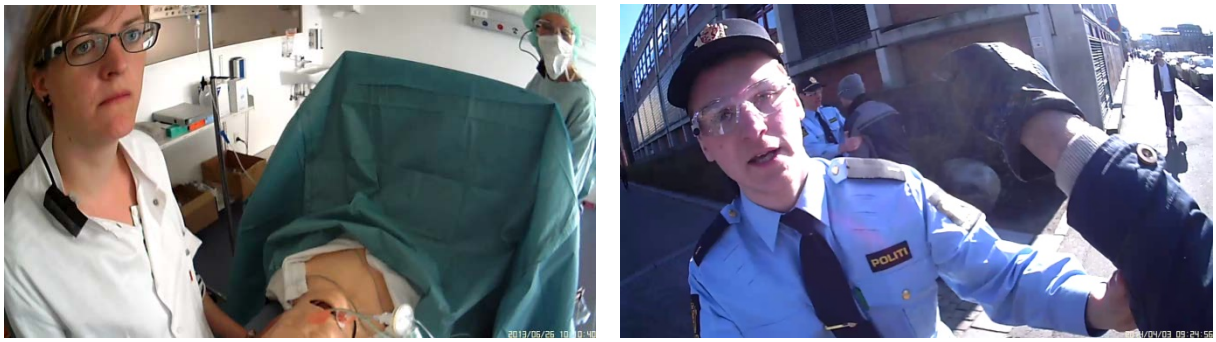

Figure 1: Figure 1: Subcams worn by research participants. Left: Anaesthetist Kirsten Gjeraa (M.D.), Danish Institute for Medical Simulation (DIMS), Capital Region of Denmark, and University of Copenhagen, Denmark and surgeon seen from the nurse's perspective. Right: cadet police officer Tore Seierstad during training for intervention seen from the trainer's perspective.

The protocol provides the participant full control over the data and more generally the process is designed to build trust, which is the key element in getting in-depth interpretation at a later stage. For example, there is a "moratorium" period before the participant hands the data to the researcher, during which s/he is encouraged to watch the film and edit out anything s/he would feel uncomfortable with, etc. The ethics protocol is strict and designed to avoid any possible harm or embarrassment to participants (see Lahlou, 2006, 2011b for details). Field preparation is an essential part of SEBE protocols, and those who use it must be prepared to invest time and efforts in it.

b) Collection of goals, emotions, and psycho-social processes

In a second stage, called "replay interview" (RIW), and occurring after having recorded her/his activity, the participant is interviewed by the researcher. S/he is asked to describe and explain her/his covert behaviour as s/he remembers it to the researcher, while watching her/his own subcam recording. Involving the person is critical because only s/he knows her/his internal states: this is also why we prefer calling them "participants" rather than "subjects" (see above in section 1 and 1.1).

Those RIW settings are video-recorded for further analysis. Indeed, we noticed that during RIW, participant often point at the objects that were relevant for attention and action on the tape ("deixis": see Figure 2). Thus, most problems of indexicality faced by pragmatics (what is the speaker referring to) are solved because physical objects are visible on the video of the RIW.

Figure 2: Extract from a subcam film of a nurse's round (left). Replay Interview of an obese person commenting how she shops for clothes (right).

High-resolution video and good sound quality of the subfilms enable detailed analysis of actions and movements. Although analysis can be facilitated by technical functions provided by video editing software, such as slow motion, zoom, etc., our replay interview method is especially powerful because it exploits another aspect of the immersion effect mentioned above. Participants apparently access some kind of *episodic memory* (Tulving, 2002) as they watch their own first-person perspective recording: remembrance is vivid and accurate, participants are assured in their comments. Probably because the recordings contain rich situated visual, auditory and kinetic cues which evoke re-enactment, participants recall with great detail their mental states at the time they acted, and can verbalize them, including their goals and sometimes sensations (e.g. thirst). We can check whether this is accurate recall or reconstruction by pausing the video and asking "what did you do next?" – and then check for accuracy.

Such effects of situated interviewing on recall have been described in the embodied cognition literature, especially regarding the positive influence of kinetic cues (Barsalou, 2009; Cole, Hood, & McDermott, 1997; Dijkstra, Kaschak, & Zwaan, 2007). It seems that the more similar the context of memory retrieval is to the context of memory encoding, the better is the recall, and that having multimodal cues helps, especially when they are spatial or motor - see the enactment effect (Engelkamp & Cohen, 1991). In other words, re-living the situation from first-person perspective would facilitate recalling one's own actions and mental states/processes. This considerably simplifies analysis and interpretation, as well as validating/falsifying research hypotheses.

To be more precise, by enabling the participants to access elements of context, we empower them to *reconstruct* what happened. Context has a double role: triggering memory and reconstituting the situation with the distributed elements which contributed to what happened. While video data provide a good – not to say the best – and faithful track of overt behaviour, it is obviously impossible to know what "truly" happened in terms of mental processes; but we obtain a very likely reconstruction that fits with the overt behaviour, that appears plausible to the researcher, and that the subject validates. It also has accurate predictive value on what happened next (see above how we check that validity with the "what did you do next" question). That is probably as far as we can get into knowing "what actually happened", and is usually enough for most research purposes. In practice, "what happened" – and this includes the why - is an inexhaustible question (Leeds-Hurwitz, 1987) because this may include a very long causal chain going back to early childhood experiences of the participant – and indeed these things do come up in the RIW.

That second stream of data provided by the replay interview technique is a ground-breaking progress in psychology. Using situated first-person recordings makes a difference. SEBE provides a device which gives the possibility of accessing the stream of thought,

reconstructing it ex-post with great accuracy, and analysing it in time and detail, away from the urge of the situation. This novel method would reopen afresh the issue of introspection which led Wundt to found experimental psychology because at the time there were no means of accessing the participants' stream of thought without disturbing it (James, 1890; Wundt & Titchener, 1904).

A key difference between a conventional post-hoc verbalization protocol and the approach of replay interview developed by our research team (Lahlou, 2011a; Le Bellu, Lahlou, & Nosulenko, 2010; Rieken, 2013) is that we let the participant lead the discussion: s/he is in control of replaying the first-person perspective video, pausing and making comments when necessary. The participant is made fully aware of what the research purpose and aims are, of our theoretical framework (e.g. we can quickly explain the bases of activity theory coding before we start), and, again, we consider her/him as a collaborator. Because the discussion is evidence-based, we can venture hypotheses of interpretation without fearing to influence the participant. Although we cannot check everything, we often take time to express our understanding and ask the participant to correct us or reformulate if needed. And in fact, in the discussions, while participants often validate our interpretations, they also often dismiss them to provide their own and ground them on evidence in the recording. This is only possible because a strong trust has been built and because we clearly express a "humble" position regarding the activity, from the moment of data collection, which is all what our protocols are about (Lahlou, 2006, 2011a; Le Bellu 2010). This trust is solid because it has been constructed from the start of capture by solid ethic safeguards. Again, as for reconstruction vs remembrance, it is impossible to tell if and to what degree the researcher influences the participant. We know this effect always exists even when the researcher is silent because participants tend to respond to non-verbal cues (Rosenthal, 1966) and can have a desirability bias. Nevertheless, the fact that participants often deny our interpretation and propose another one speaks in favour of a limited influence. The presence of the film as evidence may empower participants to resist the influence of the researcher because they can use it as a way to demonstrate the validity of their own interpretation. Attentional focus on the video is sometimes so immersive that the participant forgets the presence of the researcher and the task of verbalization; then, we have to bring back the participant's attention to the current situation, e.g. by pausing the video and asking "Hem, and at this point, what are your goals?"

1.2 Data analysis technique with SEBE

Analysing such a rich stream of data requires a solid framework and new ways of presenting the results. Description of a situation could be expanded to an infinite level of details, as shows the example of the massive "Natural History of an Interview" (Birdwhistell, 1971; Leeds-Hurwitz, 1987). This classic study analysed four very short[1] videotaped scenes over a 15-years interdisciplinary project. The manuscript was so massive, with tables that had up to 143 entries, that it could not be published. In the same vein, the sophisticated codification systems developed by ethno-methodologists and pragmatists (Sacks, 1992) are interesting but too heavy solutions for our purpose here of analysing longer video sequences (much more than a minute). Coding frame by frame would also be too labour intensive. We want analysis techniques that enable reducing the massive data to a tractable set without losing the richness of this data or of the experience of the participant in the situation. Indeed, as said above,

[1] The most famous is just the moment when Gregory Bateson lights the cigarette of the person he is interviewing.

behaviour results from what the participants intended to do (goals, motives) and the conditions provided by the environment.
Activity Theory (Leont'ev, 1978; Rubinstein, 1946) which comes in many different shades (Rogers, 2008) enables capturing goals and cutting the activity stream into chunks to be analysed. We use a version developed by Nosulenko in the filiation of Lomov's engineering psychology at the Russian Academy of Sciences (Barabanschikov, 2007; Lahlou et al., 2012; Lomov, 1981). In this version, participants (individual or collective) are driven by motives and try to reach goals. *A goal is a representation of the desired final state. The participant tries to reach her/his goals in the conditions given (the context).* This goal is usually reached through a series of steps. At each step, the participant tries to reach a subgoal.

> "So activity appears as an oriented trajectory from a given state ("conditions given") to a consciously represented expected state ("goal"). Attaining the goal(s) satisfies the motives of the person. The trajectory of activity is a succession of small problems to be solved ("tasks"), which can each be seen as reaching a local subgoal. The operator solves each task by taking *actions* (consciously controlled motor or mental moves) and *operations* (automatic, routinized moves taking place beyond the threshold of consciousness). At each moment, the participant is confronted to the possibility of taking a different local route to reach the final trajectory, and may do so opportunistically in consideration of the local conditions given at this point" (Lahlou, 2011b).

By using this framework, we can cut the stream of activity into segments where the participant tries to solve a small task, with a clear goal, in the conditions given by the environment: each task with a sub-goal becomes a segment. This operation can be subjective: there may be several ways to cut (e.g. more or less detail), but usually one way appears more satisficing regarding the purpose of research.

Installation theory (Lahlou, 2008, 2015) deals with the determinants provided by the environment and how they are interpreted by the participant. It considers three layers of determinants: 1) affordances in the built physical environment, 2) embodied competences in individuals, and 3) social influence by peers and institutions.
When SEBE is used in the perspective of action research, Installation theory serves as a reading grid to extract the most relevant elements or behavioural cues in each layer for any given action, by systematically exploring what elements of each three levels were perceived or taken into account. One can then analyse long sequences rather economically, and focus detailed coding only on the critical moments.

Section 2 demonstrates the use of SEBE for capitalising tacit professional knowledge and training nuclear plant operators; section 3 illustrates how SEBE enabled understanding better the mechanisms underlying a behavioural change, namely to create the habit of consuming more water among Polish children.

2 Capturing and transferring professional know-how

The SEBE technique has been extensively used and refined in the context of a research focusing on the capitalisation and transmission of know-how embodied in professional practices of experts, for the training of power plant operators (Le Bellu et al., 2010). The activity of the latter has a strong manual component. These visual and motor responses are guided by the goals that the operator pursues throughout the performance of her/his activity. While the activity of operators essentially entails the application of procedures, an internal

layer of tacit knowledge (Nonaka & Takeuchi, 1995; Polanyi, 1958, 1967; Ryle, 1945) has been built and shaped over the years by the experts. Tacit knowledge underlies the prescriptive aspect of the task and expresses itself in the actual work of operators. It is crucial, but quite challenging, to access. Challenging, because of the nature of knowledge gained by practice, which is embodied (Anderson, 2003; Barsalou, 2010; Varela, Thompson, & Rosch, 1991), situated (Suchman, 1987), anchored in the context (Lave, 1988b) and distributed (Hutchins, 1991; Norman, 1988). Crucial, because it is essential to preserve this competitive resource as the intellectual and know-how capital, and to pass it on to the new generations of experts. This invisible, internal, not formalised and no longer conscious part of knowledge is often directly shared between apprentices and experienced fellows through socialization practices (Nonaka & Takeuchi, 1995) such as professional craft mentoring on the work field (Argyris & Schon, 1974; Castéra, 2008; Cushion, Armour, & Jones, 2003; Furlong & Maynard, 1995; Schön, 1983; Zanting, Verloop, & Vermunt, 2003), or within communities of practice (Wenger & Snyder, 2000; Wenger, 1998). However, the current societal context of the baby-boomer generation's mass-retiring makes less and less possible those types of relationships and training settings.

While some methods in knowledge management have been developing over the past twenty years to address this issue (Earl, 2001; Ermine, Boughzala, & Ounkara, 2006; Ermine, 2010; Nonaka & Takeuchi, 1995; Srikantaiah & Koenig, 2000), it seems that techniques using visual ethnography provided by the field of social sciences are rarely used, in spite of their obvious relevance. Indeed, episodes or elements that are difficult to verbalize or have become so automated that they are unconscious for the subject can still be visible, remarkable and questioned by the observer (e.g. harmless gesture such quickly passing the hand above water pipes in order to check the temperature, providing some clue on the state of the machine); also some elements may be difficult to comment (e.g. spatial position or appearance of something, characteristic of noise) but appear very clearly on films and therefore can be pointed at and "explicated" as far as possible. We explored the SEBE and Russian Activity Theory to design a method for collecting and transferring experiential knowledge embodied in professional gestures through an educational multimedia tool for training. We define "professional gestures" as dominant perceptual-motor piece of work activity holding expert skills and guided by motives and goals (Le Bellu & Le Blanc, 2012).

This research was carried out within the largest French electricity supplier (150,000 employees). Nineteen workers, recognised for their expertise by the managers and peers of the company participated in the study. In total, a sample of fifteen professional gestures performed by those highly skilled operators, either in a real work situation (power plants), or in a re-created setting (training centre) was collected and analysed on the basis of the SEBE technique.

2.1 Data collection

During the data collection phase, all the operators wore the subcam while they were performing their gesture in order to record their activity from their own perspective. We also collected some elements of the working context with an external camera to account for the distributed aspects of the situation (interactions between the expert and other operators, tools and machines, spatial distribution), and to capture details that are poorly rendered in the first-person situated perspective. Figure 3 provides screenshots of operators performing a gesture on technical material, viewed from a third-person (external) perspective, and from a first-person perspective.

Figure 3: On the left, third-person perspective provided by an external camera; on the right, first-person perspective provided by a subcam.

Coding explicit and tacit know-how embodied in those professional gestures was thus based on two principal sources of data: (1) video recordings obtained from the subcam and external camera; and (2) audio recordings of the operators' commentaries provided by several protocols of verbalisation run at different moments of the data collection phase: before performing the gesture, during the execution of the gesture, and after having completed the gesture.

The first verbalisation protocol was a free interview run by the researcher in order to obtain a first explanation of the gesture by the expert, and some documentation such as the procedure, schemes, pictures, training documents, etc.

The second verbalisation protocol was a *goal-oriented talking-aloud* protocol (Le Bellu, Lahlou, & Le Blanc, 2009) occurring simultaneously with the video data capture. It enabled the researchers to access the expert's cognitions *in situ*: goals, the why and how of her/his way to accomplish the gesture, good practices (the subtleties of the gesture), vigilance points (warnings on hazards or risks that are not formalised in any documentation), etc.

Those two verbalisation protocols are not required in the SEBE technique; they are a specificity of the method designed for capturing know-how underlying gestures performed by professionals (Le Bellu, 2011).

Finally, the third and last verbalisation protocol was a Replay Interview (see 1.1), putting the operator in the situation of reviewing her/his own activity, from the first-person perspective provided by the subcam. As said above, the ex-post verbalisation protocol provided by the RIW enabled to notice a great recollection by the expert of her/his own activity experienced some hours, even some days ago, as well as a good level of explanation of her/his gesture. This verbalisation device allowed continuing the work of accessing the operator's psychology and reasoning process started from the first verbalisation protocol. In this context, the objective of the RIW was to empower the operator to explain the mental model and cognitive processes underlying her/his gesture, based on the goals s/he pursues, according to the principles of Activity Theory.

2.2 Data analysis

The analysis aimed to link all the verbal and visual data collected by using the structure of activity provided by the Russian stream of Activity Theory. The components of our simplified version (see above, section 1), namely goals, sub-goals, tasks and actions or operations (routine actions non longer conscious), guide the breaking down and the structuration of the activity. As a result, we can reconstruct the mental model of the gesture performed by the operator from her/his own standpoint. This mental model is represented by a hierarchical structure, so-called the "tree of goals" (see Figure 4).

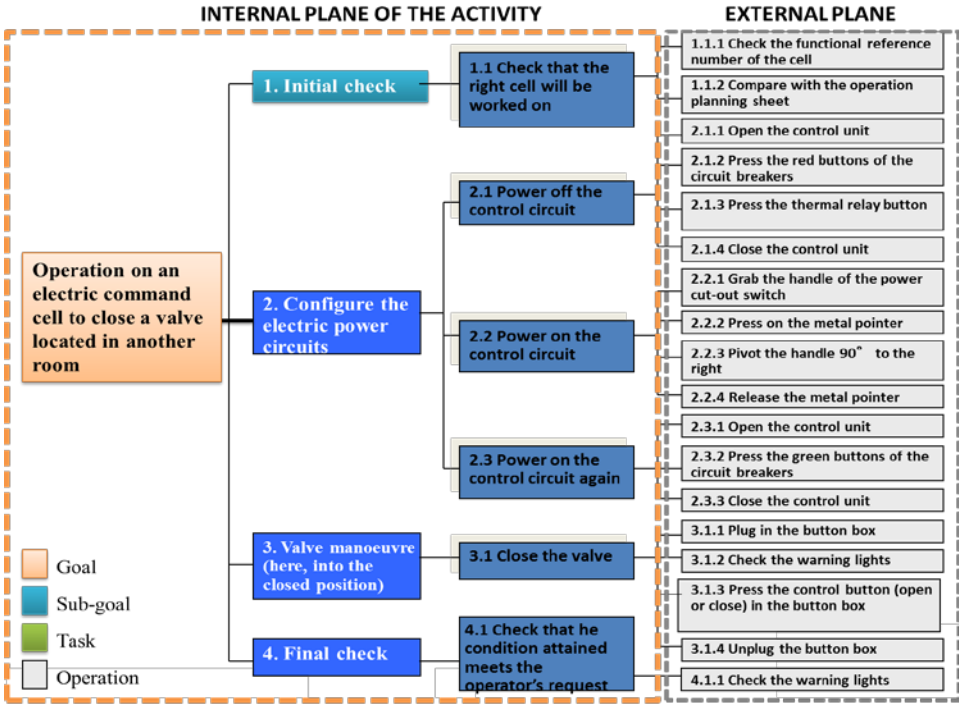

Figure 4: The mental model, named "tree of goals", of a gesture performed by an expert

This mental model provides the basis for building educational media[2] conveying experiential knowledge (see below). The model is divided into two parallel planes: (1) the internal plane of activity composed of the goal, sub-goals and tasks; this is what is invisible, situated in the expert's head (the cognitive part of the gesture); and (2) the external plane, containing operations performed in a chronological order. Components of this plane are visible. It is the perceptual-motor part of the gesture.

The goal-oriented structure of the gesture allows putting forth not only its motor dimension, but also the meaning underlying the performance. In other words, we obtain the "how" and the "why" of the gesture. The "how" provides a descriptive detailed dimension of the way to interact with objects of the system The "why" enables novices to acquire the rationale of the gesture and to understand the activity enough, in order to enable them to adapt to the local circumstances of future situations. The primary goal of the research was to provide some tools for understanding and learning purposes, and not just for capitalisation of knowledge and imitation. Therefore, the educational objective and principle of "structuring the knowledge in the best way for learning" was essential in our reflection.

2.3 Results

As a result, this case study enabled to design a novel method, ECAST, that allows to Elicit, Collect, Analyse, Share and Transfer tacit and explicit knowledge underlying professional gestures (Le Bellu, Le Blanc, & Di Benedetto, 2014; Le Bellu, submitted). ECAST leads to the building of educational software called Multimedia platform for APprenticeship (MAP) (see Figure 5 and Figure 6). It is used as a resource by trainers in professional training

[2] The final product, MAP, includes also other multimedia resources in order to provide a more complete representation of knowledge embodied in the gesture; e.g. variants, formal procedures, etc.

settings, or directly on the work field by the operators, as a tool of revision just before an assignment.

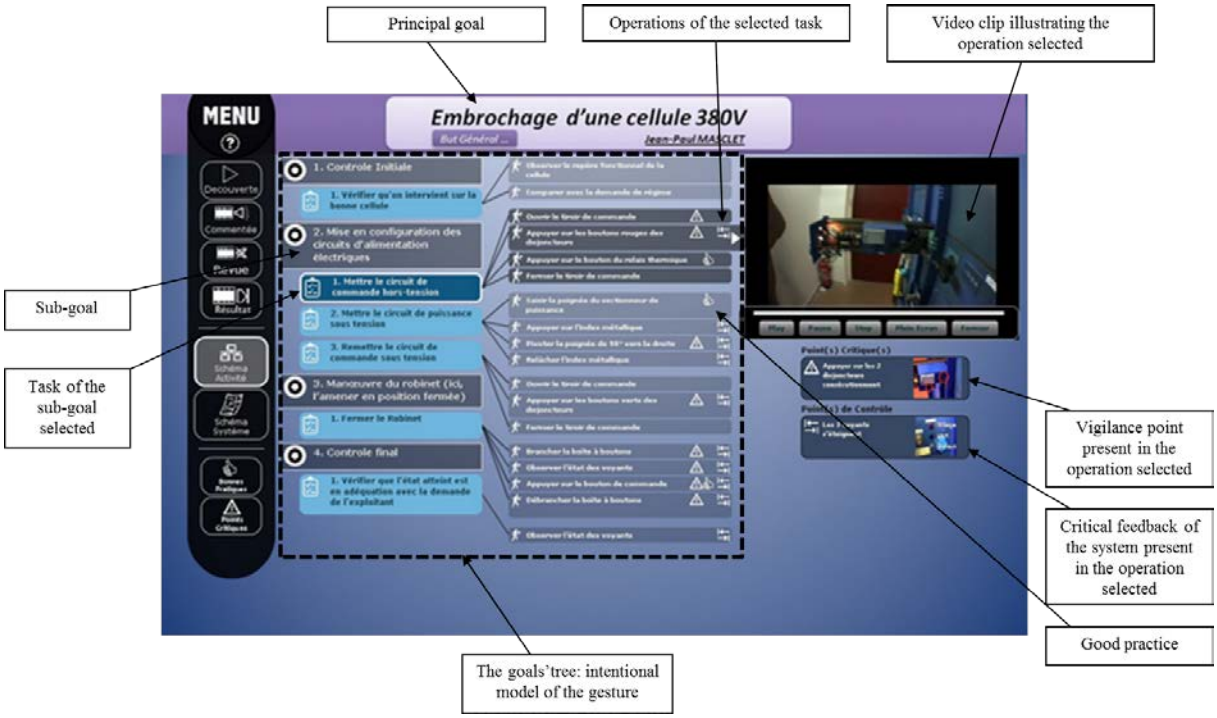

Figure 5: The chapter "tree of goals" in the Multimedia platform for APprenticeship (MAP).

Figure 6: The full video chapter of the MAP providing a synthetic view of the activity.

Based upon ECAST, the MAP is a structured audio-visual resource based on the intentional cognitive model of the expert, namely the tree of goals (see Figure 5) which provides a structured model of the gesture where each operation is illustrated by a video clip. The apprentice can therefore learn the gesture step-by-step, "walking" through the chapter "tree of

goals" at her/his own pace. In addition of this detailed vision, a synthetic view of the activity (see Figure 6) is also provided by a video which has commentary, from both first-person and third-person perspectives, and provides textual data highlighting sub-goals, tasks, good practices, vigilance points

The MAP allows putting forward the most essential points of the gesture captured from the expert's point of view so as the apprentice gets closer to a psychological posture of doing. It provides a new kind of representation of the human and professional experience for transfer by enabling the novice to share the real-time experience of the expert with the first-person perspective provided by the subcam and the explanations of the referee. It does not substitutes for real professional craft mentoring practices, but in cases where it is no longer possible, it provides an overview of the know-how that would have been transmitted from the expert to the apprentice. Thus, we try to compensate for the loss of traditional socialisation practices. This method naturally does not replace, but rather complements the current training practices, where students also have access to actually practicing the gesture.

The test of MAPs in the actual training centres of the company was a success. Improvement in the practical sessions was noted. Greater speed of execution was observed by trainers. E.g. the gesture was performed twice during the session with MAP, vs only once during the session without MAP.

> *"It went much faster! Last week, we did only one tightening; although here, they [the trainees] had not even brought their procedure"* [Teacher]
>
> *"It's a good complement. There are things that, personally, I saw in the movie, which I had not noticed during the training."* [Trainee]
>
> *"I get the feeling that we see that which is essential, and it's summarised"* **[Trainee]**

The technique has been adopted by the company and five years after the first pilot was made (Le Bellu et al., 2009), about a hundred gestures have been captured by our technique which is now part of the standard toolbox of the corporate training division. The MAPs are currently used and disseminated within the company as a tool for the training of nuclear power plant operators.

3 SEBE as a monitoring/validation method for complementing questionnaire method

Another example of the application of SEBE is its combination with more classic data collection tools such as food frequency questionnaires. People's memory of their actions is the main challenge of currently used dietary assessment methods including food diaries, 24-hour recalls and food frequency questionnaires (Vucic et al., 2009). Quantitative studies provide numbers, but the nature of the mechanisms of how exactly the effects appear remains invisible; also the possible biases behind the data collected are difficult to assess. Hence the idea to use SEBE as a quality control device to get a full qualitative and realistic view of the phenomena studied, on a small subsample. The example below illustrates the interest of combining SEBE and traditional data collection tools in the context of an intervention study in Poland. This study, which was a year-long field experiment, aimed to create the habit of consuming more water among Polish children. The research was designed by social psychologists to test the power of Installation Theory (Lahlou, 2015) to change behaviours; it was co-funded by the international research programme of a food industry player (Danone) in cooperation with local health organizations to try to substitute water to soft drinks. In Poland,

about 50% of 3 to 6 years-old children drink more than 800 ml/day of sweet beverages (sweet tea, juices, etc.) and less than 150 ml of water. This is a real cause for concern due to the fact that childhood obesity continues to rise. As the high-level of sugar in some drinks could be a contributor to this public health issue, significant life-long health-related behaviours may be established in childhood, in order to reduce such practices. Therefore, the goal of the study was to make children develop a stronger habit to drink a greater quantity of plain water per day, by "measuring" their drinking activity. 400 families (parents and children from 3 to 6 years-old) took part in the research. Among these participants, five families from Warsaw and Lodz were selected to participate in a study using SEBE.

3.1 Data collection

In this study, we followed three steps:

Step 1 - Selection of the parent taking part in the study and subcam usage
The adults taking part in the study were all filling in a specific fluid intake diaries (for 7 days) to track their child intake and their own in the context of the larger intervention study. We also specifically chose parents who stayed at home with the child in order to be able to better understand their interactions. The five mothers who were selected were asked to wear the subcam for at least ten hours during two days (mixing week days and weekends). Participants wore the subcam in parallel with completing the standard protocol of filling in the fluid intake diary.
To improve trust and compliance, participants were told that we were interested in their natural, typical behaviour at home, that there was no way to do something wrong or "fail", and there would not be any evaluation of their recorded behaviour. Additionally, in order to make them more comfortable with the task we showed them how to access their video recording, and watch it first - before the researcher. If they felt uncomfortable with what they saw on the recording, they were also briefed on the way to delete the video without having to give any reason. We also reassured them by explaining that the researcher would not have access to the deleted part of the film. As said above, this is an essential part of the protocol to build trust and ensure that participants feel relaxed.

Step 2 – Films visualization and pre-analysis
The second step consisted in watching all films collected via the subcam, and creating clips to address specific points with the participants during the next step of RIW. Films were indexed and cut into sequences with Webdiver (Pea et al., 2004). A clip was then created whenever the researchers found something "interesting" or something that we could not understand and wished to discuss with the participant. We particularly focused on exploring the adults drinking patterns (type of beverage consumed, moments of consumption, quantities, etc.), on insights on child drinking and on processes of convincing children to drink water. Moreover, we also wanted to gain insights about the usage of the fluid intake diaries: understand how the parents were using the diaries (primarily, when and how) and spot eventual missed occasions, inaccuracies in terms of quantity or moments of consumption.

Step 3 – Replay interview
In this third step, during a two-hour interview, the participants watched the clips we edited at step 2. As the participants were watching the films, we asked each parent to describe and explain her/his behaviour as s/he remembered it.

3.2 Results

3.2.1 Understanding drinking patterns and exploring the process of convincing children to drink water

Regarding the fluid intake pattern, results allow an in-depth understanding of the consumption routine: the preparation of the beverage (e.g., preparation of water with syrup for the kid or coffee with milk and sugar for the adult), the factors triggering consumption and the consumption "process" itself. Interestingly, the RIW revealed that the participants were not always fully aware of the routine and its determinants.

One important conclusion regarding drinking patterns is the fact that the practices are highly unstructured: the fluid intake is actually very fragmented (e.g., people may sip for hours from the same cup of tea – see Figure 7). We observed this type of behaviour for all the participants we analysed (Mother N sips from the jar, bottle and cup of tea: 16 occasions; mother C sips coffee, tea, and water – 21 observations; mother K. sips tea, coffee, water, and alcohol mixed with soda – 13 observations; mother KA sips tea and water – 26 observations; mother S. sips tea – 8 observations).

Figure 7: parent sipping from a cup and from a jar

Results also revealed that the consumption can be shared by two different persons in the same family. For instance, within one of the five families participating in the study, the subfilm of the parent enabled us to observe how a cup of hot chocolate had been started to be drunk by the child, and then finished later by the mother (family N.: child drinks and mother finishes the cup approximately one hour later). Additionally, our data show the impact of the context on consumption (social context such as receiving visits - family S.).

More interestingly, the SEBE data highlight factors triggering consumption. For instance, just seeing the bottle or a cup on a table may motivate the person to take a sip of the beverage, or remind the mother to offer the beverage to her child (see Figure 8). Finally, we were able to unveil unexpected motivating factors: one mother that insisted heavily for her child to drink to avoid constipation.

Figure 8: Encountering affordance in the context triggers action: mother sees cup of tea on table, takes a sip; then proposes tea to child (watching TV) who declines, then goes to kitchen to take a small bottle of flavoured milk which the child accepts. The whole sequence lasts 33 seconds.

Our results reveal strategies put in place by the parents to increase water consumption among children, which is a very interesting output since the pilot study was run in the context of an intervention study aiming to increase water intake.

Figure 9: Parent offering drink (mother comes from the kitchen with a glass of water, offers it to the child, who accepts it and drinks).

One strategy often used by the parents is to keep offering, as illustrated in Figure 9 (mother K. in two occasions; mother C. in one occasion; mother S. in RIW), or offer it in specific moments (for instance, ask for the child to drink a glass of water as she wakes up - mother S. in RIW).

Some parents also "use" the environment: they try to keep the water visible and cups and bottles always at reach (e.g., see table of family C. in Figure 8). Additionally, they also "play" on the importance of ownership for children and determine the bottles or glasses that are only

for the child (one bottle for the girl and another one for the boy in family C.; Mickey Mouse cup for the girl in family S.).

Parents are creative when it comes to making kids drink playing games (competition game between parent and child in the case of the mother K. and competition between siblings in family C. in RIW – see illustration of the sequence in Figure 10). Finally, parent participants also observed that their own behaviour is important to impact their children behaviour; therefore they try to drink more themselves (mother C. in RIW) or always drink when they ask the child to drink (mother K. in RIW).

Figure 10: Parent creates a competition game for drinking water. Drinking together to see who finishes first (left). Girl wins, Mom applauds (right).

Changing habits is certainly not an easy task and our results also expose barriers and difficulties with convincing children to drink more water. For instance, proposing the water is not always easy; it needs several repetitions until the child finally drinks or not (e.g. in one footage of 1min30s, mother K insists 3 times until child K finally drinks; in family C.: the mother asks but the child does not answer).

3.2.2 Insights on the usage of the fluid intake diaries: discoveries of limitations of current recording system

This pilot study also aimed to shed light on how the parents are using the diaries and spot eventual incorrectness. To be noted that we had film of the entire days of the parents and that no parent deleted any sequence even if they had the possibility and were clearly informed of this possibility.
Results exposed above reveal that there are indeed gaps between fluid diaries and SEBE data. We can conclude that filling in a fluid specific diary may be a more difficult task than filling in a food diary. The unstructured and fragmented drinking practices make the filling of the diaries a difficult task: it seems much harder to remember as the practices are not structured. Additionally, we observe that there is strong variability between participants (some people are quite reliable, some less) and also variability in situations (some days are simple, some less simple). Moreover, as the diaries are often filled every 2/3 days (and not once a day as advised), the impact of memory failure may be even more important. However, we also discovered practices adopted by participants to make the filling easier (e.g., write down all drinks as participants have the drink (see Figure 11), or mobilize the kindergarten and caregiver (mother S. in the RIW).

Figure 11: Parent fills in her own paper log of drinking which she will use to fill in the diary (one side for her own intake and on the other side the child's intake).

Our results indicate that SEBE can be an interesting technique to complete classic diaries approaches in the context of an intervention study. We were able not only to understand more in-depth the fluid intake behaviour and determinants but also generate insights into how the process of habits change takes place, which was the main goal of the intervention (i.e. mother S. explained in RIW that she begun by reducing the amount of syrup in the water, then she has started to offer a glass of water to her child every morning). The SEBE not only unveils some limitations of current recording system (fluid diaries), but brings ideas on how to improve it.

4 Discussion and conclusion: one method, different applications

The two very different illustrations provided in this paper show the interest and also limitations of SEBE.

The use of SEBE for capitalisation on and transfer of professional knowledge provides a powerful framework which enables the couple researcher/expert to access the expert's thoughts and reasoning. Experiential knowledge is therefore externalized through the analysis of the activity and its structuring into goals, sub-goals, tasks and operations. This level of structure provides a practical framework for video analysis and editing, which is a well-known and heavy problem of digital ethnography methods. Nonetheless, its application to the issue of knowledge management through the ECAST method was limited to manual activities, especially sequential and motor gestures. The technique needs to be adapted to allow a proper consideration of tasks distributed over time, between individuals and requiring distributed and joint decision-making. This is a vast domain; studies exploring those issues are now beginning using SEBE (Fauquet-Alekhine, 2014; Glăveanu & Lahlou, 2012; Gobbo, 2015; Rieken, 2013).
Furthermore, the subcam is a great instrument to create training films, because it provides an excellent perspective on gestures; the trainees appreciate the possibility of getting a realistic view, and the trainers as well. It is nevertheless generally needed to combine the first-person perspective with some external views of the activity to provide the learner with a larger perspective on the activity, the technical system handled (machines, tools, etc.) and the environment. Thus, depending on the combination of third-person and first-person perspectives within video editing, sometimes the learner is in the position of a spectator of the scene which promotes understanding of the context; sometimes s/he is in the position of the actor of the gesture "in the heart of the action" (through the first person-perspective). This latter perspective allows the novice to identify with the expert and to project her/him-self in the performance of the action. In this way, there is a greater cognitive involvement of the

learner. This involvement may come from better spatial cues or kinetic cues (Barsalou, 2009; Dijkstra et al., 2007; Engelkamp & Cohen, 1991; Lahlou, 2011c); more involvement of the mirror-neuron system (Rizzolatti & Craighero, 2004), among other hypotheses. We are currently testing the effect of first vs third person perspective on re-enactment and FPP seems, at least in the case of food, to provoke stronger re-enactments than third person perspective (Basso et al., in preparation).
There are limitations though. The technique can be perceived as labour intensive because it implies the use of more technical equipment and because with video extra precautions must be taken regarding ethics and image rights. Then SEBE highlights that there is a systematic discrepancy between the prescribed and the actual practice. This is obviously a well-known fact among ergonomists but it can prove problematic when made explicit and open in a training context and especially in high-risk industries where all procedures are supposed to be followed in the detail. Another issue whichthat comes in full light with SEBE is the local differences that can be emphasized between sites (e.g. industrial plants) or people. What an expert will call good practice may not be so for another. There may be good reasons for some knowledge to stay tacit.

The use of SEBE as a complement method in a quantitative survey and intervention brought two advantages.
First, it enabled to understand better the detail of behaviours that were studied otherwise in a more classic manner. We could get the detailed mechanisms by which the behavioural changes occurred: the influence of the affordances of the context on triggering liquid intake; the creative ways in which parents exerted social influence on their children to change their behaviour. Second, SEBE enabled us to understand better the technical limitations and biases of the quantitative data collection techniques (for example, the fact that intake of one drink can be distributed over time); but it also provided ideas for improvement, based on what the participants themselves invented (for example, keeping a small paper log that is filled in as intakes occur, and use it to fill in the online diary later, see Figure 11). Finally, SEBE provided good video material to illustrate the presentation of the results. This helps better documenting the protocol, showing the setting, and more generally giving a better account of the research.
The limitation of SEBE in this context is its heaviness compared to questionnaire alone. Data collection and RIW are time consuming for both the participants and the researchers.

Furthermore, whatever the context of application, other limitations of SEBE include the verbalization process and more generally the ability of the researcher to communicate with all the participants; for example, with children, or people with disabilities (e.g. Alzheimer patients).
Strangely, we did not find specific difficulties with the level of education. In the RIW setting, it seems that participants are able to explain and verbalize very clearly the activities which they usually perform. To say it otherwise, people appear experts in what they usually do, and can expand to an amazing level of detail and depth of insight in activities such as laying bricks, preparing food, etc. (see (Gobbo, 2015) for a lengthy interview where someone describes for literally hours how he buys shoes, or (Glăveanu & Lahlou, 2012) for how people paint Easter eggs). To some extent, the fact there is a film can compensate the limitations of language since what is talked about is obvious and visible on tape. We were able to hold good RIW with participants in another language than their own (e.g. in English with Danish nurses and anaesthetists, and with Norwegian police cadets) or even with the help of a translator (with a Polish brick layer, or with Polish mothers and children). The same when the researcher has an insufficient knowledge of the field, and cannot for example understand

some key concepts or issues –and therefore is not able to ask the right questions. Indeed, the quality of the RIW, as for any interview process, depends greatly upon the qualities and knowledge of the interviewer. This is why the researcher should be acquainted with the field. In practice, what happens is that the first cases enable the researcher to learn the adequate vocabulary, and the relevant objects, precisely because as a watcher of the tapes, s/he can get explanations, be situated where the action takes place, be given a good view, but s/he is not acting: a position very similar to that of "peripheral participation" coined by Lave and Wenger to describe natural professional learning in communities of practice (Lave & Wenger, 1991; Wenger, 2000).

These examples of applications show that Subjective Evidence Based Ethnography can provide unprecedented access to cognitive processes in real-world situations, enabling doing "in the real-world" cognitive studies which could so far only be done in the lab. SEBE is especially relevant to understand and explain "how things work" when one tries to train people into an activity, or modify the behaviour. SEBE proves to be especially interesting to transfer the insights provided by activity analysis, for the purpose of training or scientific communication. Moreover, its use as a complementary method on a small subsample or even better in a pilot study can improve considerably the quality of the final outcome.
Thus, the SEBE method provides a new possibility of insight into human experience, which should bring considerable progress in social science - hopefully as the microscope did in biology. The recordings are illuminating as to what are the determinants of behaviour; many previously obscure questions get clearer answers based on empirical evidence, for example how far participants rely on contextual cues vs. internal representations, or where visual attention is focused.
To sum up, SEBE can be very useful for human activity analysis and for training. It is generally helpful for ecological psychology and more broadly for approaches where interaction with the context is the focus of study (situated action, distributed cognition, interaction design, etc.). It would most certainly also have great perspectives in documenting the variability of behaviour with culture and possibly in therapy.

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