APLICACIÓN EXPLORATORIA DE LOS PROCEDIMIENTOS. PENSAMIENTO EN VOZ ALTA *Y* ESTIMULACIÓN DEL RECUERDO

MARÍA DEL CARMEN GÓMEZ-PEZUELA REYES[*]
Universidad Autónoma Metropolitana, Unidad Xochimilco

MARÍA VIRGINIA MERCAU[**]
Universidad Autónoma Metropolitana, Unidad Iztapalapa

Resumen: *Este artículo tiene el objetivo de narrar la experiencia de dos investigadoras novatas en la aplicación de dos procedimientos de investigación en sus estudios doctorales. El primero es el denominado* pensar en voz alta, *una técnica introspectiva que intenta recuperar lo que pasa por la mente de una persona mientras realiza una actividad cognitiva. El segundo es la* estimulación del recuerdo, *técnica retrospectiva que intenta que la persona recuerde lo que pensaba mientras realizaba una actividad cognitiva. En este artículo se propone mostrar las posibilidades, retos y limitaciones de estos procedimientos, así como las adaptaciones y reflexiones que ambas investigadoras consideraron en sus respectivos entornos de investigación.*

PALABRAS CLAVE: TÉCNICAS INTROSPECTIVAS; TÉCNICAS RETROSPECTIVAS; INVESTIGACIÓN CUALITATIVA; METODOLOGÍA; APLICACIÓN.

[*] mpezuela@correo.xoc.uam.mx
[**] mervim@hotmail.com

EXPLORING THE APPLICATION OF THE *THINK ALOUD* AND *STIMULATED RECALL* PROCEDURES

MARÍA DEL CARMEN GÓMEZ-PEZUELA REYES*
Universidad Autónoma Metropolitana, Unidad Xochimilco

MARÍA VIRGINIA MERCAU**
Universidad Autónoma Metropolitana, Unidad Iztapalapa

Abstract:This article will narrate the experience of two researchers new to applying two qualitative research procedures in their PhD studies. The first one is called *think aloud* (TA), an introspective technique that retrieves what is concurrently happening in the mind of the participant while performing a cognitive activity. The second one is called *stimulated recall* (SR), a retrospective method used to register the cognitive activity after a task has been done. The studies will show the possibilities, challenges and limitations of these procedures, as well as the considerations both researchers went through in their respective research fields.

*mpezuela@correo.xoc.uam.mx
** mervim@hotmail.com

INTRODUCTION

Designing and carrying out a first major project in educational research is a big challenge for PhD students. It is "quite a long journey" in which students need to learn about and develop several skills such as: planning, writing academic texts and distinguishing among different research techniques. Regarding the latter, reading empirical texts and methodological literature could be of great help, but when it comes to applying the chosen methods, a lot of questions and hesitation arise. PhD students usually belong to an active learning community in which individuals share pieces of advice regarding knowledge over a myriad of topics, bibliographic resources, courses, calls for papers, and so on. There is an explicit interest in sharing what they consider to be useful with other students, and this reciprocity takes shape in many ways: links such as study groups, PhD events on in-progress projects, among other alternatives for the exchange of academic experiences and new ideas.

This article is an attempt to make a local contribution to other Mexican PhD students who are developing a qualitative research project. The research projects described in this article are being developed in two different Mexican educational contexts: a public university and a private primary school.

Besides, this article responds to the lately acknowledged international growing awareness of the existing gap between research guidelines on how to conduct qualitative studies and the realities that novice researchers face in the fieldwork during data collection (Barnard and Burns, 2008; Hobbs and Kubanyiova, 2008). It aims to give a detailed description of the possibilities, challenges and limitations of the selected procedures in our respective research contexts.

First of all, we will present the theoretical description and guidelines for the application of *think aloud* (TA) and *stimulated recall* (SR) methods. Secondy, we will present a brief description of each of our research projects in order to set the contexts. In the third section we will describe the considerations, changes and adaptations made to the designed projects while applying both procedures.

TWO RESEARCH METHODS TO GATHER QUALITATIVE DATA: *THINK ALOUD* AND *STIMULATED RECALL*

Obtaining and analyzing what happens in the participant's mind during the acquisition and performance of a particular process are the essential characteristics of

these two methods. Namely, both of them are oriented towards observing the lines of thought of the human mind, the way in which personal and social knowledge is related, as well as the particular mapping of individual decision-making that characterizes the paths a learner follows to solve cognitive challenges. Therefore, the information provided by these methods essentially keeps a record of the particular thinking practices, instead of the account of the products or results of such thought processes (van Someren, Barnard and Sandberg, 1994; Dempsey, 2010).

Likewise, both TA and SR emphasize the subjects' voices as they perform their actions. By centralizing the observation on perceptions, feelings, and individual narratives, these methods enable the researcher to delve into the distinctive and possibly assorted elements that enrich the complexity of human reasoning and learning process. Such analysis diversity and specificity broaden the understanding of the influence of individual subtleties and the customization of the proceedings of any knowledge acquisition, as described below.

SCOPE AND LIMITS OF TA AND SR

While one of the most important and valuable aspects of these methods is that they provide the possibility of collecting more direct data on the ongoing thinking processes, cognitive research has highlighted some of their limitations, and has raised questions regarding their complete reliability in research (Moore and Zabrucky, 1989). For instance, they exhibit some intrinsic and evident limitations, such as the impossibility of getting precise accounts of what is happening in the human mind. Researchers have proved that these methods provide close and intimate information of what subjects actually do during a cognitive process, but, at the same time, warn that they cannot be considered as internal mirrors of what the participants are actually doing or thinking. As informants have to provide the researcher with intelligible discursive messages, those pieces of articulated language do not necessarily reflect what is or was taking place when performing the reported task (van Someren, Barnard and Sandberg, 1994).

One of the challenges when gathering substantive data through these methods is that most research subjects are mainly asked to perform a task which will make them go through a cognitive process without having to rationalize or explain it (Hosenfeld, 1977). Besides, as attention span and memory capacities in both methods are not exclusively focused on the cognitive process, but also on the narrative accounts, the

73

information provided could be modified, which results in having to consider some possible misinterpretations that would not allow a fully reliable picture of what is really happening in the mind of the person representing —through language— his or her own thinking process.

Despite the possible limitations of these methods, it is very important to recognize that they provide detailed and valuable information on human problem-solving construction and progress, especially in some areas such as decision-making or process tracing. Information obtained through TA and SR protocols sustain cognitive theories considering differences among people, depending on the difficulty level of the tasks, the effects of the instruction, the participants' own perspectives, and the individual characteristics and interests, among other issues (van Someren, Barnard and Sandberg, 1994). While some theories explain in general terms the cognitive patterns the human mind follows when acquiring new knowledge, these two qualitative methods are worthwhile research resources to clearly establish the coincidences and distinctions that enrich the complexity of human lines of thought (Kucan and Beck, 1997; Dempsey, 2010).

As stated above, information provided by both TA and SR protocols has widened the understanding of how to conceptualize decision-making and trace the development of cognitive processes. These key elements for the acquisition of new knowledge are essentially related to two key human characteristics. On the one hand, there are different phases any learner needs to undergo when receiving information from a particular task or concept for the first time, until they gain proficiency in that same matter. On the other hand, memory as a differentiated and limited cognitive resource influences the way knowledge is acquired and related to previous information (Newell and Simon, 1972; van Someren, Barnard and Sandberg, 1994).

ESSENTIALS OF TA AS A RESEARCH METHOD

Think aloud is a research method applied to collecting qualitative data. It essentially resides on asking people to think aloud while performing a cognitive activity in order to solve a problem or to perform a specific task. The information retrieved is then analyzed in detail by the researcher. Instead of memorizing the accounts, think alouds are done during task completion, and thereby aim to capture more direct data and a more complete image of what is happening in the mind of the reporter (Kucan and Beck, 1997: 271).

During the second half of twentieth century, there was a boost in the exploration of the human mind. The most important advancement in cognitive research was the shift of focus from the psychological inquiry that prevailed in the beginning of the twentieth century, towards behavioral approaches. In 1972, this shift of research perspective led Newell and Simon to propose the think aloud procedure as an innovative method to better understand the differentiated thinking paths of the human mind when performing problem-solving processes (Newell and Simon, 1972).

In the case of the think aloud protocols, the introspection refers to the "concurrent verbalisation" (van Someren, Barnard and Sandberg, 1994: 31) rather than the interpretation of the cognitive process by the subject performing the task. Psychologists have demonstrated that when accountings of cognitive processes are described based on memory, narrations frequently refer to what is generally considered as expected to be performed, but not necessarily to what actually happened. It is because of the impossibility of directly observing both the cognitive paths and the distinctive reasons a person has to accomplish a particular task, that the TA is still regarded as one of the most feasible procedures to know how an informant understands, implements and acquires certain knowledge and expertise.

ESSENTIALS OF SR AS A RESEARCH METHOD

Stimulated recall is defined by John Lyle as "a family of introspective procedures through which cognitive processes can be investigated by inviting subjects to recall, when prompted by a video sequence, their concurrent thinking during that event" (2003: 861). Ryan and Gass (2012) point out that SR is always a complement to other data in the sense that an audio or a video recording of a particular task or interaction is used as a stimulus for the recall. This method is applied by having the participants meet with the researcher to listen to the recording or see the video of the event. During this session, either the participant or the researcher will stop the recording at strategic points to have the participant comment on the thoughts he or she had when performing that task.

Several researchers warn us about the careful research design which is necessary to use this method in a way that it can really reveal data on the thought processes being studied (Gass and Mackey, 2000; Lyle, 2003). Stimulated recall experts highlight a number of aspects researchers must consider to make sure that the data obtained by SR is on the thought processes taking place at the moment the task was being

performed and not on new thoughts produced when watching or listening to the recording of the task.

For instance, a way to maximize the validity of the SR procedure is by timing; that is to say, having the SR session as close as possible to the performing of the recorded task. This also considers previous tasks researchers can do to get ready for the recall session, such as writing and piloting the instructions and questions, as well as considering the time they will have participants spend in the recall session. They also suggest the way questions need to be formulated to avoid data contamination, *e. g.,* using past tenses or adverbial time markers at the beginning of the utterance (Gass and Mackey, 2000; Ryan and Gass, 2012).

OUR RESEARCH CONTEXTS

In the following table we describe the research field contexts, the research aims, participants' profiles, recruitment procedures, time frames and methods (see Table 1).

Researcher A's data collection was conducted at a small private school in Mexico City. Since her aim was to study primary EFL teacher's beliefs and knowledge about primary students' development of speaking skills in English, she looked for a school in which groups were small and which offered several hours of EFL lessons a week. Her subjects of research are three EFL primary teachers. The research questions are about their knowledge and beliefs concerning the development of the students' speaking ability, as well as the teachers' corrective feedback techniques.

The data collection methodology in which SR was applied consisted of two monthly sessions with each teacher. First, each of them informed researcher A when they were going to have activities related to their students' oral development, and invited her to observe and audio-record the session. Just before each of these sessions researcher A applied a semi-structured interview, mainly about the teacher's objectives and expectations. During the class observation, the researcher took notes. According to the methodology of this study, an SR session should follow each observation. Before describing how SR sessions developed, it is worth mentioning that this was the first time researcher A applied this method and the procedure described in this article corresponds to the pilot study and the first part of the PhD's project.

TABLE 1: RESEARCH CONTEXT

	RESEARCHER A (SR)	RESEARCHER B (TA)
Primary aims	To find out about EFL primary teachers' knowledge and beliefs regarding: 1. the development of their students' speaking ability in English 2. corrective feedback regarding students' speaking ability in English	To identify key compensatory processes performed by pharmacology undergraduate students
Participants	Three EFL primary teachers	Twelve pharmacology students in their third year of professional studies with limited English proficiency who have begun reading academic texts in that language as a need to get some specific knowledge
Recruiting participants	She visited some private and public primary schools where she offered an exchange of professional teacher development sessions so she could do her PhD project	Students whose academic program requires intensive and demanding reading in English for academic purposes
Time frames	Data collection: April-July 2016	Data collection: February-November 2016
Methods	Interviews with teachers Class observation Field notes Stimulated recall Researcher reflective journal	Weekly reflexive logs Think aloud Stimulated recalls Individual and group interviews

77

APPLICATION OF SR: RESEARCHER A'S CONCERNS AND SOLUTIONS

As described above (Table 1), each round of data collection consists of an interview right before the class observation and an SR session right after it. Throughout the seven rounds of data collection, the researcher could only have three SR sessions, and none of these followed the ideal timing conditions in which this procedure should be applied.

Most of the questions were designed following the advice of experienced researchers regarding the use of past tenses and the collocation of time markers at the beginning of the utterances, but the time factor could not be controlled. The main problem was that the SR sessions usually took place several days (5 days or more) after the recorded event. The reason for this was that primary teachers were too busy with the many duties they are in charge of: teaching, looking after the children at recess, organizing school festivals, filling in forms, etcetera. As explained in the previous section, a delay in the application of SR can affect the subjects' capacity to recall the thoughts they had during the recorded session.

A second issue is that the participants may react differently to the SR procedure. In this study, only one out of the three subjects seemed to be able to recall parts of the event while listening to the recording. She offered a vivid description of the situation and explained her thoughts at the time of the event.

> Investigador: Ahí por ejemplo ¿ves que estás esteee, traduciendo?
> Participante: Mhmm…
> I: Eeeee, tu motivación es ¿cuál? ¿Lo que dijiste hace un momento? De…
> P: En ese caso es porque, veo sus caritas que se quedan en blanco o sea justo en esa veo que no, o sea no, no están entendiendo, no, no les está pasando, es algo como muy o sea eso todavía…
> I: Abstracto ¿no?
> P: Muy abstracto para ellos, o sea no lo han aterrizado.[1]

---

1 Researcher: There, for example, do you realize that you're translating?

Participant: Mhmm…

R: Uhm, your motivation is... what? What you've just said? About…

P: In this case it is because I see their faces that look like they don't understand, I mean, exactly in this occasion I see that they don't understand, the meaning is not going through, it's something

The two other subjects did not go through an introspective process. Instead, they seemed to explain their beliefs and knowledge about the event. Calderhead (1981) refers specifically to the application of sr in research on teaching. He mentions two factors that could explain the results of the sr limitations experienced by the two subjects mentioned above. The first one is that several aspects may influence the extent to which teachers recall and report their thoughts. On the one hand, listening to or watching their lesson recordings can be stressful or cause them anxiety. The second limiting factor is that teachers may hold certain tacit knowledge acquired through experience, which is part of their teaching practice, but since it has never been verbalized before, it may not be spontaneously expressed during the sr. Along the same lines, he reports that some teachers' practices could have reached an automatization level, which means that they may have long forgotten the reasons why they act in that way.

He also mentions that Nisbett and Wilson (cited in Calderhead, 1981) asserted that what the subjects report about their higher-order cognitive processes is not the result of direct introspective awareness, but the recalling of *a priori* causal theories which the participant considers appropriate to explain his or her thoughts (Calderhead, 1981: 213). Since primary schools are really busy places as a research setting, they require great flexibility from the researcher to adapt to on-the-spot schedule changes and his capacity to take the opportunities as they come up. This means, *e. g.*, being ready with the recording equipment for any rescheduling of the planned data collection sessions.

Secondly, novice researchers can profit a lot from knowing as much as possible about the theoretical aspect of the methods to apply and from piloting them. Ryan and Gass (2012) narrate the kind of testing Ryan did to avoid as many problems as he could consciously foresee. Thirdly, novice researchers' learning-by-doing shows that data collection is a creative process that does not end when the project design has been approved by the university. On the contrary, they need to continue reading more and more about various methods to find out if they are feasible, and if it is sensible to adapt or combine them with different ones.

---

like too… I mean, still…

R: Abstract, right?

P: Too abstract for them. I mean they haven't grasped it yet.

In the ongoing data collection process researcher A decided she would continue trying out sr sessions, mainly with the subject who showed the ability and facility to do the task. She also decided to implement a higher number of observation sessions with all of the participants because she noticed that the school setting and timing allowed post-observation brief interviews more easily than sr sessions. Furthermore, she learnt that the researcher-participant relationship needed to develop in a healthy, ethical and friendly way, which implies getting to know each participant really well and making the necessary adjustments to deepen this knowledge, since the final target in qualitative research is to be able to report the participants' views as closely as possible.

RESEARCHER B'S PROCEDURE

Researcher B's study is a purposeful sample of twelve pharmacology graduate students who are native speakers of Spanish and who face, for the first time, the academic demand of reading pharmacology expository texts in English with no previous formal foreign language instruction, neither in their preceding school stages nor during their undergraduate studies. All students are enrolled in the third year of the pharmacology program in a Mexican university, a particular period when they consult manuals to make different pharmaceutical and cosmetic formulations on an almost daily basis. It is worth mentioning that in the Spanish context, there is a lack of bibliographic resources in that area of study, so most of the information available is written in English.

The main objective of this research is to identify the key literacy practices performed by the participants in order to better understand the particularities of this sociocultural practice, which is sometimes referred to by the participants as one of the most challenging enterprises and unavoidable in their academic development. As literacy goes beyond "the mere ability to read and write" (Brandt, 1990: 9), and it essentially refers to the complex interplay between the text-driven information and the reader and/or writer, the research questions of this second investigation are about the reading paths the participants follow to compensate for reading deficits, such as the lack of linguistic knowledge of English. It is also about the activation of previous knowledge —considering that some new academic topics could be introduced in such texts, participants' perspectives may be about their own reading processes as well as their expectations, feelings, and perceptions about the literacy practice in their academic community.

The data collection methodology in which the TA is being applied consists of nine monthly sessions with each participant (108 total). As a starting point, with the suggestion and help of a pharmacology professor, researcher B selected nine texts with topics related to the pharmacology courses, and which have a similar length and level of syntactic difficulty. Once the texts were selected, participants individually attended a 60-minute session to read aloud one of the nine texts at a time. There was a training session in which instructions and practical examples were detailed. Instructions referred to the interest and profitability of expressing not only what they understand when reading, but also what they are doing in terms of the reading process, as well as what they are actually feeling and thinking in those particular moments. To explain the TA's essentials more clearly, she used a variety of different videos (available on *YouTube*) where TAs are performed and explained. In each session, the researcher iteratively gave instructions highlighting the purpose of the procedure. Each complete session was video-taped and, at the end of the reading, the researcher asked certain general questions about the experience.

APPLICATION OF TA: RESEARCHER B'S CONCERNS AND SOLUTIONS

As stated by different think aloud practitioners, such as van Someren, Barnard and Sandberg (1994), as well as Kucan and Beck (1997), this method of inquiry provides the closest direct data to know what happens in the participants' minds. However, as in their own reported research where TA is the main method to gather qualitative data, in the present research students are not used to verbalizing what they are really feeling while carrying out the task. Actually, most of the information gathered refers to what students understand instead of what they do to get that information, and it hardly refers to their perceptions and feelings. In order to redress this information gap, the researcher attempted to provide two resources that could clarify the purpose of the procedure, and some emerging solutions to facilitate the participants making overt accounts of the inaccessible domains of their cognitive processing.

The first external resource the researcher used was showing the participants different *YouTube* videos to model out the method, emphasizing the type of information reported. The key points observed in the video were recurrently marked as a starting point in every TA, so the students kept in mind what was expected from them. The second resource was the use of banners with written questions which were shown to the participant when the researcher wanted to prompt specific information which was not being referred to by the pharmacology student during the progress of the

TA. The reason for using such signs was that the researcher observed that in order to avoid dialogue, the possibility of seeing the written questions could prompt the participants to express their thinking process more directly.

Up to this point of the research, each participant has carried out five out of the nine TAs. Despite the usefulness of the external resources, all participants continued providing narrations mostly related to their comprehension of the text, and hardly ever did they delve into more introspective thoughts such as the processes they followed to retrieve the information. Although this is true, it is worth mentioning that as the practice of the TAs progressed, the researcher noticed that participants provided more introspective accounts. The possible reasons for this gradual change is not only the familiarization with the technique but also the closer interaction between the participant and the researcher, which allowed them to gain more confidence in the social interaction needed for this kind of inquiry.

Taking into account two critical points related to this method can help improve its application. The first one (mentioned above) is that to provide substantial information, participants must get used to the process of expressing their inner thinking. The researcher needs to be aware of the fact that some sessions may not provide the expected information. Then, they would turn into some kind of preliminary session of the final evidence. The second point is that due to the nature of introspective information, participants need to build a relationship of confidence with the researcher, which cannot be taken for granted. This emphatic rapport is sometimes more attainable with some participants than with others. When considering these two critical points, it is advisable to include a larger number of participants in case some of them are not keen on the method.

FINAL COMMENTS

At first, PhD students may have the idea that conducting their main research project will be a quite straightforward exercise consisting in following what they had originally planned. Naively it may be thought that by reading enough research manuals and empirical articles, it will be possible to follow a clear-cut route. As Russell notes, the idea of pursuing a sequence of pre-planned procedures in teacher education research and in other qualitative studies is far from reality (cited in Hobbs and Kubanyiova, 2008). While researchers need to be sufficiently creative and flexible to make the necessary planning and adjustments of a series of theoretical and methodological

aspects during data collection, there are some preliminary steps that can substantially favor the application of the research methods. Among them is the application of a pilot-testing process which could offer not only the possibility to make the necessary changes as a result of its analysis in action, but also offer a vital chance for the researcher to get trained in the competence to grasp what is expected from the information that has been gathered.

Articles like the ones compiled by Barnard and Burns (2012) and Hobbs and Kubanyiova (2008) unveil the specific challenges and obstacles that arise in research projects, as both suggest possible options to overcome difficulties. With this article, we also attempted to modestly contribute to this emerging collection of the learning-by-doing in qualitative research.

From our incipient research experience, it is necessary to highlight the richness qualitative inquiries provide as they allow us to reveal the complexities and subtleties when considering the descriptive representation of a particular task from a particular context. While theoretical assumptions provide the framework to better understand the objectives and application of research methods of inquiry, it is researchers who need to be responsive and analytical so they can select the right procedures in the particular scenario of their research and ensure they will work in the given research context. This implies a long learning process oriented to gaining dexterity in applying the selected procedures which needs to be paired with a strong desire to be truthful to what is observed in the development of the whole study. By this we mean that, although the research design can be very flexible in qualitative inquiries, in the end, it represents a tight network built by all its elements.

BIBLIOGRAPHY

Barnard, Roger and Ann Burns (eds.) (2012), *Researching Language Teacher Cognition and Practice International Case Studies*, Bristol, Multilingual Matters.

Block, Ellen (1986), "The comprehension strategies of second language readers," in TESOL *quarterly*, vol. 20, no. 3, September, pp. 463-494.

Brandt, Deborah (1990), *Literacy as Involvement: The Acts of Writers, Readers, and Texts*, Carbondale, Southern Illinois University Press.

Calderhead, James (1981), "Stimulated recall: a method for research on teachers," in *British Journal of Educational Psychology*, vol. 51, no. 2, pp. 211-217.

Dempsey, Nicholas (2010), "Stimulated recall interviews in ethnography," in *Qualitative Sociology*, vol. 33, no. 3, pp. 349-367.

Gass, Susan and Alison Mackey (2000), *Stimulated Recall Methodology in Second Language Research*, New York, Routledge.

Hobbs, Valerie and Magdalena Kubanyiova (2008), "The challenges of researching language teachers: What research manuals don't tell us," in *Language Teaching Research*, vol. 12, no. 4, pp. 495-513.

Hosenfeld, Carol (1977), "A preliminary investigation of the reading strategies of successful and nonsuccessful second language learners," in *System*, vol. 5, no. 2, May, pp. 110-123.

Kucan, Linda and Isabel Beck (1997), "Thinking aloud and reading comprehension research: inquiry, instruction, and social interaction," in *Review of Educational Research*, vol. 67, no. 3, autumn, pp. 271-299.

Lyle, John (2003), "Stimulated recall: a report on its use in naturalistic research," in *British Educational Research Journal*, vol. 29, no. 6, December, pp. 861-878.

Moore, DeWayne and Karen Zabrucky (1989), "Verbal reports as measures of comprehension evaluation," in *Journal of Reading Behavior*, vol. 21, no. 3, September, pp. 295-307.

Newell, Allen and Herbert Simon (1972), *Human Problem Solving*, New Jersey, Prentice-Hall.

Ryan, Jonathon and Susan Gass (2012), "Stimulated recall," in Roger Barnard and Ann Burns (eds.), *Researching Language Teacher Cognition and Practice International Case Studies*, Bristol, Multilingual Matters, pp. 144-161.

Takako, Egi (2008), "Investigating stimulated recall as a cognitive measure: reactivity and verbal reports in SLA research methodology," in *Language Awareness*, vol. 17, no. 3, pp. 212–228.

van Someren, Maarten, Yvonne Barnard, and Jacobijn Sandberg (1994), *The Think Aloud Method. A practical guide to modelling cognitive processes*, London, Academic Press.