Implicit and explicit motor learning in preterms.

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Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON31165

Source
ToetsingOnline

Brief title
Implicit and explicit motor learning in preterms.

Condition

- Other condition

Synonym
prematurily born children

Health condition

prematuriteit

Research involving
Human

Sponsors and support

Primary sponsor: Universitair Medisch Centrum Sint Radboud
Source(s) of monetary or material Support: Ministerie van OC&W,er wordt een junior onderzoeker aangesteld bij het NICI;daarnaast is een aanvraag gedaan ingediend bij NWO;open MAGW Program;zie bijlagen

Intervention

Keyword: motor learning, pediatric rehabilitation, preterms, working memory

Outcome measures

Primary outcome

In all three series of experiments in both, the graphical task and the button-box task, reaction time, response time, and response errors will be registered. In the graphical task more detailed registration of pen-kinematics is also performed to allow for analysis of learning on multiple levels (e.g., related to planning and execution of the movement). Second, participants have to complete verbal protocols that describe *rules, methods, techniques* they may have become aware of during the learning process. These assessments allow us to ensure that *implicit learners* have indeed learned implicitly.

Repeated Measures ANOVA's will be used to compare the effects of condition and group on learning results.

In the third series of experiments especially the time course of error reduction, reaction time, and response time reduction will be analysed because these measurements inform us on the formation of the different memory representations.

Secondary outcome

not relevant

Study description

Background summary

Motor skills can be learned implicitly and explicitly. Implicit learning is the ability to acquire a new skill by doing it unaware of the regularities governing the task. The procedural knowledge gained is difficult or even impossible to access consciously and has been shown to be relatively independent of both age (Meulemans et al., 1998) and IQ (Reber et al., 1991).
In explicit learning, on the other hand, declarative knowledge is used to build up a set of performance rules that guides motor output. Berry and Broadbent (1988) demonstrated that the application of declarative knowledge requires the availability of working memory, whereas, the application of procedural knowledge does not.
Ample studies on implicit and explicit learning in neurologically intact individuals have assumed that explicit learning may only proceed with intact working memory (Maxwell et al., 2003). In the proposed project, we will examine motor learning in preterm children. These children are likely to develop working memory deficits, despite the absence of known neurological disorders (Stewart et al., 1999). Moreover, these children are highly at risk to develop motor performance and learning problems (Evensen et al., 2004; De Kleine et al., 2006). There have been no studies in preterms that directly relate deficits in working memory formation to motor skill learning, despite its theoretical relevance for understanding the cognitive factors affecting learning and its applied relevance for rehabilitation and recovery (Krakauer, 2006).

Study objective

The first aim in the proposed project is to directly test the alleged role of working memory on (explicit) motor skill learning in preterm children.
Our second aim is to examine the relation between implicit and explicit learning in preterms. This is especially relevant, as the potential mediating role of explicit working memory for this interaction can be unveiled. Specifically, if working memory is indeed an important factor mediating the (facilitatory or inhibitory) interaction effects found in previous studies, we do not expect such effects in the group preterms with profound working memory deficits. Finding such an absence of interference in preterms with deficits in working memory allows us to draw more specific inferences related to cognitive substructure of motor learning.
The third aim is to study the formation of memory representations underlying explicit and implicit learning, until present not systematically been studied

in preterms. It is still an open question how the deficit in working memory affects the nature of memory representations sub serving both types of learning. It may be speculated that the memory representation sub serving explicit learning in the preterms is incompletely formed, or even impossible to form, owing to a deficit in working memory, and as a consequence these participants may need to *resort to* effector-dependent memory representations for this type of sequence learning.

Study design

Randomized experimental design with two *experimental* groups and one control group of the same age range (5-8 years), yielding three groups: -1- preterms with mild/absent working memory deficits, -2- preterms with severe working memory deficits and -3- typically developing children matched on age and IQ. These three groups allow us to make the relevant comparisons of interest related to our research questions, while at the same time control for the effect of prematurity per se on learning (addition of group 2).
Implicit and explicit learning will be examined in the three groups separately on two distinct tasks that are modified versions of the Serial Response Time Task (SRT). The first task will be performed on a digitizing tablet, and the second task will be performed on a customized button-box task. First, the SRT task is probably the most robust paradigm to study implicit and explicit learning, already successfully applied in clinical groups, second, the use of pen-displacement data and the concomitant analysis of multiple variables allows us to more precisely determine the different levels at which learning might be effective.

In the basic set-up of the SRT tasks the participant is required to react as quickly as possible to stimuli that are displayed on the computer monitor by either moving the pen to the corresponding location on the digitizing tablet, or by pressing the corresponding key on the button-box.
During implicit learning trials the sequence of stimuli follows a structured pattern, i.e., is governed by a set of rules or is completely random. Trials with random sequence are intermixed with those having a structured sequence, such that discovery of the structured sequence is made less probable.
During explicit learning trials children are informed either verbally (e.g., numbering of consecutive stimuli) or visually (the figure they have to draw) about the sequential ordering of the stimuli.

Aim #1: In the first series of experiments we will scrutinize the alleged role of working memory for learning in preterms, in particular for explicit learning. Children of each of the three groups will be randomly assigned to two subgroups with a different task order, yielding a total of 6 groups (n=15 for each group). All children learn both tasks implicitly and explicitly, the order of which is counterbalanced. During the learning phase, all children will learn both tasks in 2 consecutive days. As explicit knowledge about sequence regularities on a specific task may disturb implicit learning, all children will start each task in an implicit learning condition, either in the first session or in the second session following a pause period of 1 month (to obviate possible carry-over learning effects). After learning-day 2 in the first session and learning-day 4 in the second session participants enter the test session after a pause of half an hour.

In the test session, participants will first repeat both tasks to assess the extent to which learning had taken place under implicit and explicit conditions. For this purpose, participants also have to perform both tasks under secondary task loading (e.g., counting, or random letter generation) to test the assumption that performance is more robust for the *implicit learners* under secondary task loading.

Aim #2: In the second series of experiments we focus on the interaction between implicit and explicit learning, specifically, on the effect of explicit information on an implicitly learned task. This is examined for one of the two experimental tasks described above, the choice of which is based on the results of the first series of experiments. Again the three experimental groups are split in half, yielding six experimental groups (n=15). Participants are randomly assigned to either the *pure* implicit learners (control groups), or implicit learners that receive explicit learning trials also (experimental groups). For all groups, learning will take place on 3 consecutive days. On day 2 and 3 of learning, the experimental groups are given explicit information about the task. Specifically, they are informed on the repeating sequence in some of the trials, or are provided with a schematic drawing of the repeating sequence. Participants in the control groups continue to learn implicitly on days 2 and 3. At the end of day 3, participants enter the test session which will be similar to test session described in the first series of experiments (Aim #1). After 1 week, retention testing is performed on day 4 for all participants.

Aim #3: In the third series of the experiments, we will examine the nature of the memory representations sub serving implicit and explicit learning. For this purpose, the button-box task is used. As in the first series of experiments participants are randomly assigned to the implicit or explicit learning group. Participants will learn a button-box task, i.e. learning a particular sequence of the keys, on 3 consecutive days. One of the crucial measurements in the third series of experiments is the transfer test that is administered following each day of learning, and at day 4. Specifically, transfer of learning from a learned condition to a novel condition is evaluated, the methodology of which closely follows Bapi et al. (2000). These transfer tests allows us to infer if memory representations are coded in spatial or motor coordinates.

Study burden and risks

Three series of experiments are conducted. In each series of experiments a new number of children are recruited. So this means that each child participates a

maximum of 4 days in one experiment. The pause time differs in the first, second and last series. The duration of each session is 30-45 minutes, so a total time of 2-3 hours. The tasks are age related and children like to learn such computer tasks.
There is no risk in these task conditions. For the parents of the children some burden is present because at this age they have to transport them or to reserve time in their own time schedule for the visits.
However, insight in learning processes in this group of children is of great importance to build up a body of knowledge in the rehabilitation programs.

The control children will be tested at school. These children will perform the some neuropsychological tests to allow comparison with the preterms. So for them the time investment per child is prolonged with 2 hours. However, also these children like to do the tests, so no burden or risk is present. However, interference with school activities can be present. We will arrange the organisation of the study activities in consultation with teachers and parents to reduce the burden as most as possible.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Children (2-11 years)

Inclusion criteria

age 5-8 years, Intelligence score within the normal range (85-115).
Two groups are selected: -1- preterms with mild/absent working memory deficits (as measured with a working memory test),
-2- preterms with severe working memory deficits (as measured with a working memory test)
no severe handicaps: normal vision with or without glasses, normal hearing and no severe motor handicaps.
Normal children: no health problems that could affect the test performance, matched to the preterms on age, gender and intelligence score.

Exclusion criteria

severe behavioral problems, severe motor problems, no parental informed consent.

Study design

Design

Study type:	Observational non invasive
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Single blinded (masking used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	01-09-2007
Enrollment:	270

Type: Anticipated

Ethics review

Approved WMO
Application type: First submission

Review commission: CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL17984.091.07