

## Consolidation of complex motor skill learning: evidence for a delayed offline process

Diva Lugassy, Jasmine Herszage, Raphael Pilo, Tamar Brosh, Nitzan Censor

*Sleep*, Volume 41, Issue 9, September 2018, zsy123, <https://doi.org/10.1093/sleep/zsy123>

**Published:** 22 June 2018    **Article history** ▼

Views ▼   Cite   Permissions   Share ▼

### Abstract

Following initial acquisition, studies across domains have shown that memories stabilize through consolidation processes, requiring a post-acquisition temporal interval to allow their occurrence. In procedural skill memories, consolidation not only stabilizes the memory, but also simultaneously enhances it by accumulating additional gains in performance. In addition, explicit skill tasks were previously shown to consolidate through sleep, whereas implicit tasks were consolidated following a time interval which did not include a period of sleep. Although previous research has been instrumental in utilizing simple motor tasks designed to model skill learning, whether and how skill consolidation processes operate in complex real-life environments remains to be determined. Here, we tested consolidation in a complex motor skill, used to train execution of fine-motor movements. Since the complex task was explicit, we hypothesized that consolidation will be evident immediately following sleep, as in simple explicit motor skills. However, results show that even though participants were aware of the goal of the complex skill task, consolidation was evident only 24 hr following skill acquisition, and not following a shorter 12 hr interval, even when the latter included sleep. An additional experiment verified that without a temporal interval longer than 12hr, the same skill training does not undergo complete consolidation. These results suggest that task complexity is a crucial characteristic determining the proper terms allowing full consolidation. Due to the enhanced ecological validity of this study, revealing the differences between complex and simple motor skills could enable the facilitation of advanced rehabilitation methods following neurological injuries.

[skill learning](#), [sleep](#), [procedural memory](#), [consolidation](#), [fine-motor](#), [offline gains](#)

© Sleep Research Society 2018. Published by Oxford University Press on behalf of the Sleep Research Society. All rights reserved. For permissions, please e-mail [journals.permissions@oup.com](mailto:journals.permissions@oup.com).

This article is published and distributed under the terms of the Oxford University Press, Standard Journals Publication Model ([https://academic.oup.com/journals/pages/open\\_access/funder\\_policies/chorus/standard\\_publication\\_model](https://academic.oup.com/journals/pages/open_access/funder_policies/chorus/standard_publication_model))

Topic:

[motor skills](#)

[memory](#)

[rehabilitation](#)

[sleep](#)

[memory consolidation](#)

[procedural memory](#)

[facilitation](#)

[verification](#)

**Issue Section:** [Cognitive, Affective and Behavioral Neuroscience of Sleep](#)

You do not currently have access to this article.

## Sign in

Don't already have an Oxford Academic account? [Register](#)

### Oxford Academic account

Email address / Username [?](#)

Password

[Sign In](#)

[Forgot password?](#)

[Don't have an account?](#)

### Sleep Research Society members



[Sign in via society site](#)

### American Academy of Sleep Medicine members



[Sign in via society site](#)

### Sign in via your Institution

[Sign in](#)

### Purchase

## Short-term Access

To purchase short term access, please sign in to your Oxford Academic account above.

Don't already have an Oxford Academic account? [Register](#)

Consolidation of complex motor skill learning: evidence for a delayed offline process - 24 Hours access

EUR €36.00

GBP £28.00

USD \$45.00

## Rental



This article is also available for rental through DeepDyve.



[View Metrics](#)

### Email alerts

[New issue alert](#)

[Advance article alerts](#)

[Article activity alert](#)

[Subject alert](#)

---

[Receive exclusive offers and updates from Oxford Academic](#)

## More on this topic

Slow Wave Sleep and REM Sleep  
Awakenings Do Not Affect Sleep Dependent  
Memory Consolidation

Impaired Sleep-Related Memory Consolidation  
in Primary Insomnia—A Pilot Study

The Relative Impact of Sleep and Circadian  
Drive on Motor Skill Acquisition and Memory  
Consolidation

Motoneuronal Excitability During Wakefulness  
and Non-REM Sleep: H-Reflex Recovery  
Function in Man

Related articles in

Google Scholar

Related articles in PubMed

All that wheezes at night is not asthma.

Sleep macro-architecture and micro-architecture in children born preterm with sleep disordered breathing.

Citing articles via

Google Scholar

CrossRef

Latest | Most Read | Most Cited

Characterization of the sleep disorder of anti-IgLON5 disease

Actigraphic detection of periodic limb movements: development and validation of a potential device-independent algorithm. A proof of concept study

Simultaneous tonic and phasic REM sleep without atonia best predicts early phenoconversion to neurodegenerative disease in idiopathic REM sleep behavior disorder

Residual symptoms after natural remission of insomnia: associations with relapse over 4 years

Sleep duration and fragmentation in relation to leukocyte DNA methylation in adolescents

Looking for your next opportunity?

Chair of Pain Research  
Boston, Massachusetts

PEDIATRIC EMERGENCY PHYSICIAN  
Saskatoon Shines, Saskatchewan

Endowed Chair of Occupational Health/Medicine  
Saint John, New Brunswick

CHIEF OF THE DIVISION OF ALLERGY, IMMUNOLOGY AND INFECTIOUS DISEASE  
New Brunswick, New Jersey

View all jobs

[About SLEEP](#)

[Editorial Board](#)

[Author Guidelines](#)

[Facebook](#)

[Twitter](#)

[Contact Us](#)

[Purchase](#)

[Recommend to your Library](#)

[Advertising and Corporate Services](#)

[Journals Career Network](#)

Online ISSN 1550-9109

Print ISSN 0161-8105

Copyright © 2019 Sleep Research Society

[About Us](#)

[Contact Us](#)

[Careers](#)

[Help](#)

[Access & Purchase](#)

[Rights & Permissions](#)

[Open Access](#)

#### Connect

[Join Our Mailing List](#)

[OUPblog](#)

[Twitter](#)

[Facebook](#)

[YouTube](#)

[Tumblr](#)

#### Resources

[Authors](#)

[Librarians](#)

[Societies](#)

[Sponsors & Advertisers](#)

[Press & Media](#)

[Agents](#)

#### Explore

[Shop OUP Academic](#)

[Oxford Dictionaries](#)

[Oxford Index](#)

[Epigeum](#)

[OUP Worldwide](#)

[University of Oxford](#)

*Oxford University Press is a department of the University of Oxford. It furthers the University's objective of excellence in research, scholarship, and education by publishing worldwide*

Copyright © 2019 Oxford University Press

[Accessibility](#) [Get Adobe Reader](#)

[Cookie Policy](#)

[Privacy Policy](#)

[Legal Notice](#)

[Site Map](#)