Summary based on a workshop report published in Hebrew

Reading the Reading Brain: Linguistics, Brain and Education Research on Reading in General, and on Reading Arabic in Particular

Prepared by Avital Darmon and Itay Pollak, editors of the workshop report, July 2012.

Abstract

The report summarizes a workshop on recent research in reading acquisition and on the challenges facing native Arabic speakers in developing reading skills in Modern Standard Arabic (hereafter, MSA). This workshop, convened by the Initiative for Applied Education Research, of the Israel Academy of Sciences and Humanities, was organized with the aim of promoting an interdisciplinary discussion of the research evidence available and in order to explore the ramifications of this evidence to education policy and practice .Empirical evidence suggests that two factors might account for difficulties encountered in developing basic reading skills and reading comprehension in MSA. The first is **diglossia** - a sociolinguistic phenomenon with at least three reflexes exerting a direct effect on literacy development: 1). the linguistic distance (difference, or mismatch) between Spoken Arabic vernaculars (SAV) and MSA in all domains of language: phonology, morpho-syntax, and lexicon (in Israel, for example, it was found that only 20% of the words in the lexicon of five year old children have an identical form in Spoken (SAV) and modern standard (MSA) Arabic; 2).Due to the cognitive status of MSA as a second language, a heavier burden is created on the executive functions mechanism of the brain; 3). Psychological, socio-cultural and ideological factors – For example, the higher status attributed to MSA leads to lack of recognition of the spoken vernacular as a legitimate language variety and a stepping stones in literacy development. The second factor that might account for the difficulty in acquiring reading in Arabic, especially in the initial stages, is the **complex orthography** of Arabic. This effect is manifested in the inability of the right hemisphere of the brain to recognize Arabic letters (based on visual pathways and Trails tests). Instruction of MSA in the early stages should take into account these challenges while scaffolding students' learning.

The workshop took place in July 2011, with the guidance of a team of experts:
Prof. Joseph Tzelgov (chair), Prof. Shaul Hochstein and Prof. Elinor Saiegh-Haddad

The full workshop report in Hebrew is available as of May 2012.
The summary of the full report, its table of contents and bio sketches of the workshop speakers and of the report editors follow in the next pages

Table of Contents of the full (Hebrew) report

Summary

Research on language acquisition and on the connections between language and reading development at large, and particularly in Arabic, has been the focus of empirical research by Israeli scholars for over a decade now, using designs and methods deriving from a wide variety of disciplines including psycholinguistics, neurocognition, education and others. This research converges on the idea that two language-specific factors might explain observed difficulties in developing reading skills in MSA among Arabic native speakers. These are Arabic diglossia and the Arabic orthography.

In Israel, ~25% of the total number of first graders in the country are Arabic native speakers. All of these children enroll in Israel-Ministry funded and supervised Arab schools where Arabic is used as the medium of instruction and where Hebrew and English are taught as foreign languages only later (starting in the 3rd and 4th grade, respectively). Despite the fact that Arabic is the first language of these children, national and international assessment reports have revealed significant gaps in the reading scores of Hebrew speaking and Arabic speaking students in favor for the Hebrew speakers (the gap in the Programme for International Student Assessment [PISA] amounts to one standard deviation, for example). These gaps in reading performance between the two language groups have stimulated public concern in Israel and have encouraged scientific research into factors that might underlie them. Considering the extent and advances of the research in this field, The Israel Academy for Sciences and Humanities decided to convene an inter-disciplinary workshop with the aim of: a) sharing and discussing evolving research questions, methods and findings and b) promoting an academic, evidence-based discussion of potential implications and utility of this evidence to bridging the gap between research and practice in Arabic language and reading education. Findings were presented by scholars from various disciplines (linguistics, psycholinguistics, brain research, bilingualism, cognition and neurocognition). This section was followed by a discussion in which practitioners and decision makers were also involved.

Main findings

Reading is a dynamic process of creating a mental map of the text. This requires the ability to map the potential meanings of words in a given textual context, and choosing the preferred meaning based on a statistical, probabilistic analysis of the content offered by the text as well as other pieces of linguistic and general information. This is a dynamic process of constant updating, assessment and decision making as the reader proceeds from decoding a single word to reading sentences and paragraphs. The better the readers' lexical quality the better they read. In Semitic languages, the word itself encapsulates a lot of linguistic information, which is very helpful for comprehension.

In Arabic, there is a linguistic distance between the written and spoken language varieties (MSA and SAV), which resembles to a large degree the condition of bilingualism. Bilingualism is associated with higher meta-linguistic abilities as well as high involvement of higher general executive functions (The brain manages two lexical systems [relating to one

conceptual system] that are active at all times, and makes on line decisions which one to inhibit according to the language spoken or read at a certain time). Given the diglossic condition and the developing understanding of bilingualism in linguistics, cognitive and brain research, several researchers embarked on a journey to unravel core questions in reading acquisition in Arabic in two routes – one focusing on the linguistic differences between the SAV and MSA; the other focusing on the orthography and its representation in the brain.

Based on studies in socio- and psycholinguistics, several factors were suggested as possible explanations for the difficulties in learning MSA, including the linguistic distance between MSA and SAV, acquisition of the two language varieties, and beliefs and practices in the community and in the teaching of Arabic. Linguistically, there are substantial linguistic differences between MSA and SAV; these differences have only increased with time because of the dynamic nature of SAV and the rather stable and uniform structure of MSA.

In a study examining 5 year old Arabic speakers in Israel it was found that 40% of the words in their lexicon have a completely different form in MSA, 40% of the words are partial cognates (paired lexical items) and only 20% are have the same form in both varieties and will thus be familiar to children when they begin to read in MSA. Another research study showed that children are not always aware of the linguistic relatedness between MSA and SAV words and that this awareness depends of the degree of distance between the two forms in the two language varieties. The effect of these linguistic differences on linguistic functioning in reading was tested directly and it was found that this distance disrupts the acquisition of basic reading skills in Arabic.

In a diglossic situation, and unlike a standard-with-dialect context (like the African American vernacular-Standard English context) code selection in Arabic (choosing MSA or SAV) is context-based not user-based. This restricts even further the use of MSA by many speakers who are proficient and capable of using it but who do not use it because the context does not require it (as in the home for instance). Also, all Arabic native speaking children acquire the spoken vernacular naturally as a mother tongue. In contrast, MSA is acquired primarily as a result of instruction in reading. Therefore, MSA is no one's mother tongue and learning it depends heavily on schooling. The linguistic distance, together with the restricted opportunity for practice in a primarily written language variety (MSA) results in reduced proficiency in MSA and avoidance of it by many non-proficient speakers who find it easier to fall back on SAV or on foreign languages. All this places enormous responsibility on the school system in enhancing the language and reading skills of children. .

Another important factor that might account for some of the problems in reading acquisition in Arabic is the absence of vowelization (الحركات) in unvoweled Arabic which makes the Arabic script deeper and harder to read than in shallow orthographies (e.g. Finnish). However, research in Israel has shown that even very young children (and also reading disabled) use the morphological structure of Arabic words (root and pattern) in reading and spelling in Arabic. This implies the utility of morphological training in reading instruction and intervention.

Additional factors that might affect reading acquisition in Arabic were presented based on a series of cognitive and neurocognitive studies that focused on the representation of the language and the Arabic orthography in the brain: In a study that tested monolingual and bilingual Kindergarten and first grade children using language and metalinguistic awareness tasks (language arbitrariness, phonological awareness) it was shown that Arabic speaking children have abilities characteristic of bilinguals (e.g. higher meta-linguistics abilities alongside a smaller vocabulary), resembling the abilities of Hebrew-Russian bilinguals. In another study, the *cognitive* status of MSA was assessed using repetition priming effect in MSA, SAV and Hebrew. The study demonstrated that the cognitive status of MSA among Arabic speakers in Israel was similar to that of a second language.

Higher metalinguistic ability should be associated with higher reading ability. In other words, research on bilingualism suggests that the enhancement of executive functions and higher meta-linguistic skills characteristic of bilinguals (such as phonological awareness) assists bilinguals in acquiring reading. Given that, it was asked whether Arabic speakers take advantage of their higher bilingual-like metalinguistic abilities in acquiring reading skills. A series of comparison studies on monolinguals and bilinguals in Israel showed that, whereas Russian-Hebrew bilingual speakers decode words more accurately and rapidly than Hebrew monolingual speakers, word decoding among Arabic speakers is less accurate and less fluent than monolinguals or other bilinguals. So, Arabic speakers do not translate their higher meta-linguistic and meta-cognitive abilities in the early stages into better reading skills. This pattern appears to persist into adulthood: A study of 16 year old Arab speakers presented with the oral and visual version of the Trails test, showed that they recognize and declaim Arabic letters at the same speed as they do for Hebrew letters and numbers. Yet, in the visual test they recognized Hebrew letters faster than Arabic letters. This suggests that the visual complexity of the Arab orthography bears on the difficulty in developing reading skills.

Several neuropsychological studies were conducted in an attempt to unfold the representation of this complexity at the brain level. Usually the left hemisphere cooperates with the right hemisphere in the comprehension process (through phonological and lexical routes). Visual pathways tests explore how each of the hemispheres contributes to this process. Those tests revealed that in the identification of Arabic letters, the right hemisphere makes many more errors (similar to the number of errors that Hebrew speakers make in recognizing Arabic unfamiliar letters). This suggests that when Arabic speakers read Arabic, the right hemisphere acts as if it does not recognize Arabic letters. The visual characteristics of the Arabic orthography make it difficult for the right hemisphere to participate in letter identification processes, thus holding back the development of reading skills. The diglossic condition further strengthens this effect, as the rate of retrieving the sounds of letters was found to be slower when the letter represents a sound that does not exist in the SAV of children.

Based on these findings it seems that the diglossic condition and the complex orthography of Arabic make the development of reading in Arabic harder than it is in other languages. These findings emphasize the need for further research into the relationship between MSA and the

various spoken vernaculars (a practical outcome of such local studies could be the development of children's dictionaries of overlapping and distinct words in the two language varieties). A more informed understanding of the relationship between the two language varieties will allow a theoretically sound scaffolding of the acquisition of MSA through a linguistically informed analysis of the common and the different between MSA and each of the vernaculars.

Furthermore, improved evidence-based instruction should take into account the complexity of the Arabic orthography; probably by explicit instruction and by allowing sufficient practice in bottom-level reading processes, children would develop automaticity in letter identification and word-identification

Bio Sketches of the workshop speakers and editors (in alphabetic order):

Merav Ahissar, professor of psychology, coordinator of the Cognitive Science area in the Department of Psychology, researcher at the Center for Neural Computation at the Hebrew University of Jerusalem; member of the National Institute for Psychobiology in Israel. Prof. Ahissar holds a Ph.D. from the Department of Neurobiology, Life Sciences Institute at the Hebrew University of Jerusalem, received in 1994.

Iman Awadie, head of the Arabic tests area, Testing Division, at the Israel National Authority for Measurement and Evaluation in Education (RAMA). Her main areas of interest are development of comprehensive tests of native-tongue Arabic including summative assessment tests and tests of language: in-school tools for formative assessment, translation and adaptation of assessment tools and tests in various subject matter areas such as international tests (PISA, PIRLS, TIMSS, and others). In 2003, she was a participant in the Mandel Leadership Institute's Young Educational Leadership for the Periphery program. Ms. Awadie holds an M.A. in education systems management and development from the University of Haifa, received in 1999.

Avital Darmon, Founding director of the Initiative for Applied Education Research (since 2003). Served as a Biology teacher in High Schools. Founder and past director of the National Center for Biology Teachers, under the auspices of the Hebrew University and the Ministry of Education. Dr. Darmon is a graduate of Mandel's School of Education Leadership (SEL), and past director of the Mandel School for Educational Leadership, Jerusalem. She served as a member of subject and curriculum committees for the Ministry of Education (Biology, Science and Technology) and on committees focusing on teacher-related issues. Dr. Darmon holds a Ph.D. in biology (1985) and Teacher's Certificate (1988) from the Hebrew University of Jerusalem.

Zohar Eviatar, professor in the Department of Psychology, University of Haifa and member of the Institute of Information Processing and Decision Making. Her main areas of research are hemispheric specialization in higher cognitive functions, language and the brain, individual differences in lateralization, and the neuropsychological basis of reading. Prof. Eviatar holds a Ph.D. in psychology from UCLA, received in 1990.

Yosef Grodzinsky, professor (emeritus) in the Department of Psychology at Tel Aviv University, professor and Neurolinguistics Chair in the Department of Linguistics at McGill University. He is a visiting professor in the Department of Cognitive Science and The Edmund and Lily Safra Center for Brain Sciences at the Hebrew University of Jerusalem. His research is in the area of neurolinguistics and the biological basis of language, brain imaging and neuroanatomy. Prof. Grodzinsky holds a Ph.D. in linguistics and cognition from Brandeis University, received in 1985.

Shaul Hochstein, Professor of neurobiology at the Institute of Life Sciences and the Interdisciplinary Center for Neural Computation at the Hebrew University of Jerusalem. He is the director of the National Institute for Psychobiology in Israel. His research focuses on different levels of the visual system, from transduction of absorbed light in the eye, through processing of visual information by the eye and brain, to construction of representations of the visual scene in the hierarchy of areas of the cortex, storing these representations in memory, and learning and acquisition of perceptional skills. Prof. Hochstein holds a Ph.D. in zoology from the Hebrew University of Jerusalem, 1972.

Raphiq Ibrahim, head of Arabic Language Program in the Department of Learning Disabilities and senior researcher at the Edmond J. Safra Brain Research Center for the Study of Learning Disabilities at the University of Haifa. His areas of interest are psycholinguistics and neuropsychology. His research in psycholinguistics focuses on visual word perception, reading processes, speech perception and production, and bilingualism (diglossia). His studies in neuropsychology focus on hemispheric specialization of higher cognitive functions with emphasis on the neuropsychological basis of reading and language dysfunctions. For several years, he also served as the senior clinical neuropsychologist in the Cognitive Neurology unit at the Rambam Medical Center. He did his post-doctoral work at the University of Haifa in the field of neuropsychology. Dr. Ibrahim holds a Ph.D. in education and cognitive psychology from the Hebrew University of Jerusalem, received in 1998.

Kawthar Jabir, chief inspector at the Ministry of Education for native language Arabic instruction, lecturer in Arabic language and literature at the University of Haifa and Sakhnin College, and a member of the Arabic Language Academy. She did her post-doctoral studies at the University of Pennsylvania in Philadelphia in the field of teaching creative writing in schools and colleges. Her areas of expertise are Arabic language and literature, creative writing, children's literature and Arabic instruction. Dr. Jabir holds a Ph.D. in Arabic literature from the University of Haifa, received in 2006.

Itay Pollak, Academic coordinator of the Board on Language and Literacy. He Holds a B.A. in history and political science from the Hebrew University of Jerusalem (2002). Mr. Pollak served as a research assistant at the Mandel Institute and a teaching assistant in the Dept. of Political Science at the Hebrew University of Jerusalem. Implemented and integrated business management and resource planning systems and was responsible for quality assurance in the computer division of Malam Team. Mr. Pollak holds an M.A. in political science, received from the Hebrew University of Jerusalem in 2008.

Anat Prior, lecturer in the Department of Learning Disabilities at the University of Haifa. Her areas of research are language processing and representation of meaning among bilinguals, reciprocal influences in bilinguals' linguistic systems, implications of bilingualism on cognitive functioning, and the importance of meaning for creating connections in verbal memory. Dr. Prior holds a Ph.D. in psychology from the Hebrew University of Jerusalem, received in 2005.

Dorit Ravid, professor in the School of Education and the Department of Communication Disorders at Tel Aviv University. Her main areas of research are native Hebrew language acquisition, development of linguistic literacy, later language development, development of reading and writing texts and spelling acquisition. Prof. Ravid serves as the vice president of the International Association for the Study of Child Language and president of the Israeli Linguistic Circle. She is a member of most Ministry of Education and Israel National Authority for Measurement and Evaluation in Education committees addressing linguistic education from kindergarten through secondary school, and serves as the steering committee chair of the PIRLS tests in Israel and the AMIT tests. Prof. Ravid holds a Ph.D. in linguistics from Tel Aviv University, received in 1988.

Elinor Saiegh Haddad, Professor of Linguistics in the English Department at Bar-Ilan University Department and academic advisor to the University's rector. She serves as the vice president of the Academy of the Hebrew Language, is a member of various advisory committees both at the Ministry of Education and at Israeli National Authority for Measurement and Evaluation in Education (RAMA); she is the scientific advisor at the Center for Technology Education on the subject of advancing native Arabic literacy. She is a member of the steering committee for development of Arabic reading material according to PISA criteria and a member of the PIRLS test international experts committee. Her main research interests focus on reading acquisition: cognitive and linguistic factors, psycholinguistics of reading, diglossia and bilingualism. Prof. Saiegh-Haddad holds a Ph.D. in Applied Linguistics from Bar-Ilan University in 1999.

Joseph Tzelgov, Professor in the Department of Psychology at Ben-Gurion University of the Negev. His main research interests are automaticity in psychological processes; acquisition of cognitive skill with particular reference to reading, numerical cognition, bilingualism and conscious processes; and, methodology and statistics in psychological research. Prof. Tzelgov holds a Ph.D. in psychology from the Hebrew University of Jerusalem in 1981.