Title of Project：Field-based Cognitive Neuroscientific Study of Word Order in Language and Order of Thinking from the OS Language Perspective

KOIZUMI Masatoshi
(Tohoku University, Graduate School of Arts and Letters, Professor)

Research Project Number：19H05589　Researcher Number：10275597
Keyword：Psycholinguistics, Neurolinguistics, Cognitive Science

【Purpose and Background of the Research】

Many studies have shown that sentences in which Subject precedes Object (SO sentences) have a processing advantage, and hence are preferred, over OS sentences. This empirical evidence of the preference for SO word order, however, is not conclusive, because it comes exclusively from SO languages. It is not clear, therefore, whether the SO word-order preference represented the basic word order of individual languages (= individual grammar view) or reflected a more universal cognitive characteristic of humans (= universal cognition view).

In order to clearly distinguish the impacts of these two types of factors, it is necessary to verify them based on OS languages. This study compares SO languages (Japanese, Tongan) with OS languages (Truku, Kaqchikel) in order to clarify factors that determine word-order preference in human languages and the relationship between word order in language and order of thinking.

【Research Methods】

Specifically, this study will examine the following:

(A) Effects of word order and context on sentence processing load in natural discourse: We will investigate the main effects and interactions (and their timing) of (i) individual grammatical factors, (ii) universal cognitive factors, and (iii) contextual factors, affecting sentence processing load in natural discourse comprehension and production, by means of behavioral experiments, functional brain imaging, and so on.

(B) Effects of context on word order choice in sentence production: We will investigate the main effects and interactions (and their timing) of (i) individual grammatical factors, (ii) universal cognitive factors, and (iii) contextual factors, affecting the choice of word order during natural discourse production, by means of corpus studies, behavioral experiments, eye tracking, and functional brain imaging.

(C) Language acquisition: We will investigate the developmental changes in (A) and (B) above during language acquisition, using naturally occurring utterances, behavioral experiments, eye tracking, functional brain imaging, and so on.

(D) Order of thought: It has been suggested that the most natural order of thought is universally "Actor-Patient-Act" regardless of the mother tongue of the speakers (e.g., Goldin-Meadow et al. 2008). We will test whether this generalization holds true of native speakers of OS languages through the analysis of gesture production, eye tracking, and other.

【Expected Research Achievements and Scientific Significance】

Research such as the above will correct past theories that were biased towards the properties of SO languages and contribute to clarifying cognitive mechanisms that determine language. Furthermore, past research on the relationship of language and thought mainly studied meanings or ideas at the vocabulary level, but this research transcends this to positively clarify the "relationship of language and thought" at higher levels such as the sentence or conversation level. In addition, the United Nations has decided that "endangered languages must be preserved to secure and encourage cultural diversity," and one key significance of this study is its ability to contribute to society in this regard. In conclusion, this study intends to create a new research area that may be called "the Integrated Field-based Comparative Cognitive Neuroscience of Language," which is expected to foster the academic development of young researchers and produce many academic and social ripple effects such as those described above.

【Publications Relevant to the Project】

・Koizumi, Masatoshi, Yoshiho Yasugi, Katsuo Tamaoka, Sachiko Kiyama, Jungho Kim, Juan Esteban Ajsivinac Sian, Lolmay Pedro Oscar García Mátzar. On the (non)universality of the preference for subject-object word order in sentence comprehension: A sentence-processing study in Kaqchikel Maya. *Language* 90: 722-736. 2014.
・Yasunaga, Daichi, Masataka Yano, Yoshiho Yasugi, and Masatoshi Koizumi. Is the subject-before-object preference universal? An ERP study in Kaqchikel Maya. *Language, Cognition and Neuroscience* 30: 1209–1229. 2015.

【Term of Project】 FY2019-2023

【Budget Allocation】 153,500 Thousand Yen

【Homepage Address and Other Contact Information】

https://researchmap.jp/read0184124/?lang=english

Title of Project：The longitudinal study on the effects of early childhood education and care on child development

NOZAWA Sachiko
(The University of Tokyo, Graduate School of Education, Associate Professor)

Research Project Number：19H05590　Researcher Number：10749302
Keyword：early childhood education and care, child development

【Purpose and Background of the Research】

Numerous longitudinal studies conducted in western countries have shown that the quality of early childhood education and care (ECEC) exerts long-term effects on child development and well-being. The enhancement of the quality of ECEC is issues that take precedence for many countries. However, the quality of the ECEC on offer has not been adequately examined in Japan.

This study will first, longitudinally examine the effects of the quality of ECEC on the development and the sense of well-being of children. The multidimensional quality of ECEC environment including their structural and process-related quality will be scrutinized in detail and will be evaluated. Second, the efforts by local governments to ensure and to improve the quality of ECEC will be assessed. Third, an effective means of ensuring and improving the quality of ECEC will be contemplated and implemented on the basis of the outcomes of the first tow investigations.

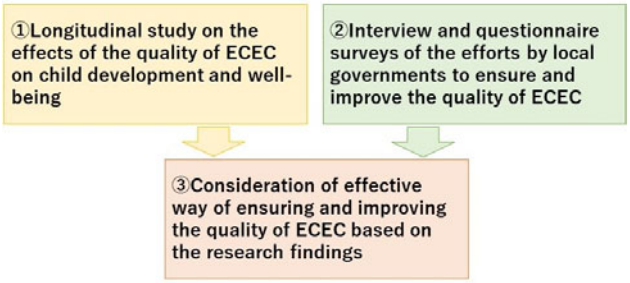
【Research Methods】

In the first part of the study, the factors that influence the development and the sense of well-being of children in ECEC settings will be examined longitudinally from age 0. Consent to participation in the study will be obtained in writing and privacy protection will be ensured for all participants. The study is designed to be unique because it intends to examine the environmental properties of ECEC settings such as the temperature, humidity, CO2 concentrations, and noise levels as indicators of structural quality. These properties will be measured via an environmental sensing system developed by members of the research team for the present study. This same team has also developed a Japanese process quality assessment tool. This tool and the conventional early childhood environmental rating scale (ITERS, ECERS) will be utilized to evaluate process quality. The emotional availability of teachers will also be assessed.

The second aspect of the study, will incorporate interview surveys and a nation-wide questionnaire will be administered to local government officials to examine the efforts of local authorities to ensure and to advance the quality of ECEC environments.

The third part of the study, will be grounded on the findings obtained from the first and second parts. At this stage, the researchers will consider and will implement an effective method of ensuring and augmenting the quality of ECEC settings.

【Expected Research Achievements and Scientific Significance】



Very few longitudinal studies have been conducted in Japan on the effects of ECEC on child development. The present study provides valuable data on the quality of Japanese ECEC. In particular, measurement tools newly developed by the research team of the current study will be used and unique data will be collected. Therefore, this study is expected to inform ECEC policy and practice and to contribute to guarantee and to ameliorate the quality of childcare and education in Japan.

【Publications Relevant to the Project】

S. Nozawa, Y. Yodogawa, M. Takahashi, T. Endo, & K. Akita 2017 Review of International Research on the Quality of Infant and Toddler Education and Care. Bulletin of the Graduate School of Education, The University of Tokyo, Vol.56, 399-419.

Y. Obuchi, T. Yamasaki, S. Toriumi, M. Hayashi, S. Nozawa, M. Takahashi, T. Endo, & K. Akita 2017 Environment Measurement and Action Analysis in Nursery Schools using IoT Cameras. IMPS 2017, P5-8, Nov. 20-22, 2017.

【Term of Project】 FY2019-2023

【Budget Allocation】 85,500Thousand Yen

【Homepage Address and Other Contact Information】

http://www.cedep.p.u-tokyo.ac.jp/projects_ongoing/kaken_s/

Title of Project：The Origin and Evolution of Sociality: Developing new theories of human evolution based on collaboration between anthropology and primatology

KAWAI Kaori
(Tokyo University of Foreign Studies, The Research Institute for Languages and Cultures of Asia and Africa, Professor)

Research Project Number：19H05591　Researcher Number：50293585
Keyword：sociality, human evolution, anthropology, primatology, field study

【Purpose and Background of the Research】

Many primates, including humans, are gregarious, living with others in a variety of ways: sometimes peaceful, and sometimes hostile/competitive. Humans in particular are able to coexist not only face-to-face, such as in pairs, families, and co-habitation groups, but also in extremely large, more abstract, “imaginary” groupings, as evidenced by the co-existence of ethnic groups, peoples, and even mankind as a whole. Underpinning these diverse forms of coexistence is nothing less than the higher-order "sociality". The purpose of this study is to construct a new human evolution theory with "sociality" as a key. To this end, we will develop interdisciplinary joint research focusing on dialogue with neighboring fields, and in particular based on collaboration between two field studies: anthropology and primatology.

【Research Methods】

In this study, we will adopt the humanities and social science perspective and methodology of ethnography in the broad sense to observe and describe the interaction process between individuals who meet as social beings, paying attention to "locality" and "totality" in the fields of human cohabitation groups and wild primate groups. However, it is difficult to collect data for comparative analysis of comparable quality and quantity from different types of cohabitant populations with starkly different activities and complexities, for example, across species. Therefore, one of the main research objectives of this study is to develop the survey method itself. The first step will be to apply “focal individual sampling”-a methodological approach common in primatology for observing and describing interactions between individuals - to anthropology, as well as elaborating upon a method of collecting qualitative data on said interactions between individuals.

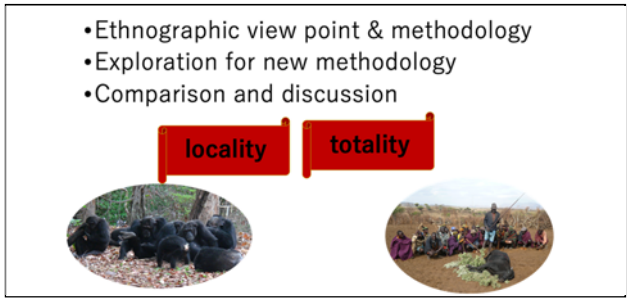


Figure 1　Research methods

【Expected Research Achievements and Scientific Significance】

Studies of various human characteristics within the framework of evolution are under way in many disciplines today. Humanities and social sciences can add new perspectives to the discussion on evolution. In this research, we will conduct a comparative study on "sociality" across regions and cultures, as well as species. This raises the possibility of overcoming the tendency often seen in studies describing evolution towards reductive formulation and reliance on mathematical theory to reduce explanations of social behavior and cultural phenomena to a matter of individuals and genes. After all, the ultimate challenge of anthropology is to reveal "where we come from, who we are, and where we are going," and so it must look for ways to answer those questions.

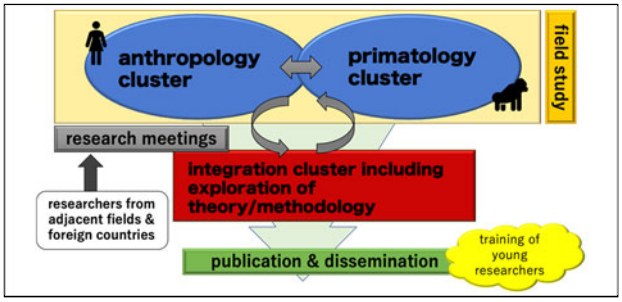


Figure 2　Research procedure and organization

【Publications Relevant to the Project】

Kawai, K.(ed.), *Others: The Evolution of Human Sociality*, Kyoto University Press & Trans Pacific Press. (2019)
Kawai, K.(ed.), *Institutions: The Evolution of Human Sociality*, Kyoto University Press & Trans Pacific Press. (2017)
Kawai, K.(ed.), *Groups: The Evolution of Human Sociality*, Kyoto University Press & Trans Pacific Press. (2013)

【Term of Project】FY2019-2023

【Budget Allocation】130,400 Thousand Yen

【Homepage Address and Other Contact Information】

http://human4.aa-ken.jp

Title of Project：The Origin of the Tribal Society in the Near East: Comprehensive Study of the Pre- and Proto-historic Nomadic Cultures in the Arabian Peninsula

FUJII Sumio
(Kanazawa University, Emeritus Professor)

Research Project Number：19H05592　Researcher Number：90238527
Keyword：Arabian Peninsula, nomadic society, tribalism, Neolithic, Bronze Age

【Purpose and Background of the Research】

Our current understanding of the Near East falls into two extremes: ancient civilizations as romantic images, and the Islam as a less familiar geo-political entity. In this sense, it is highly vulnerable and far from comprehensive. Among others, the nomadic society, another aspect of the Near Eastern society, is trivialized into one of historical, geographical and ethnological landscapes and, for this reason, not subject to full-scale human and social sciences with the only exception of anthropological surveys. Archaeology is no exception to this. The only way for breaking through this situation is to step into the drylands outside the *Fertile Crescent* and patiently collect up the archaeological footprints of ancient nomadic tribes.

This study aims to: 1) reorganize the study of pastoral nomadization in the Near East from the conjecture-level argument based on indirect information from the urban-rural society within the Fertile Crescent to the substantive discussion associated with specific site names and precise dates; and, in so doing, 2) shed new light on the historical peculiarity of the Near Eastern society, tracing back to the formation process of nomadic tribes.

【Research Methods】

Toward this goal, this research project implements the comprehensive investigation of pre- and proto-historic nomadic cultures in the Arabian Peninsula, focusing on the five millennia spanning from the early Neolithic when sheep and goats were first domesticated to the Early Bronze Age when full-scale nomadic society based on tribalism is supposed to have been established (**Fig. 1**). The target research fields include the al-Jafr Basin (southern Jordan), the Hijaz Highlands (NW Saudi Arabia), the Majma/Thumamah Plain (central Saudi Arabia), Bahrain Island, and the eastern desert of Egypt.

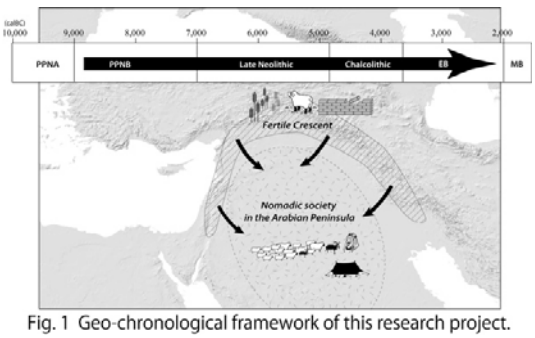


Fig. 1 Geo-chronological framework of this research project.

The focal points of our discussion are the social organization of pre- and proto-historic local nomads and its diachronic and synchronic change during the key five millennia. The investigation approaches the issues from multiple perspectives including palaeo-environment and climatic changes, burial practice and social organization of local nomads and their diachronic/synchronic transition, migration pattern of nomadic tribes viewed from production and circulation of prestige goods and wool-shearing flint tools (i.e. *tabular scrapers*), appearance and expansion of rock-engraved tribe signs (i.e. *wasm*), history of water-use technology, osteological and genetic characteristics of tribesmen and their livestock, and structure and history of corrals. In addition, with a view to exploring the relationship between the internal structure of a cemetery and the social organization behind it, the investigation also plans sociological and anthropological studies of cemeteries of modern nomadic tribes.

【Expected Research Achievements and Scientific Significance】

This study is expected to fundamentally revise the Near Eastern history greatly biased to the urban-rural society within the Fertile Crescent. The challenging revision would deepen our understanding of the bimodality or dimorphism of Near Eastern society past and present.

【Publications Relevant to the Project】

・Fujii, S. (2013) Chronology of the Jafr Prehistory and Protohistory: A key to the process of pastoral nomadization in the southern Levant. *Syria* 90: 49-125.
・Fujii, S. (2018) Bridging the enclosure and the tower tomb: new insights from the Wadi al-Sharma sites, north-west Arabia. *Proceedings of Seminar for Arabian Studies* 48: 83-98.

【Term of Project】FY2019-2023

【Budget Allocation】136,700 Thousand Yen

【Homepage Address and Other Contact Information】

Under construction.

Title of Project：Holistic research on the spread and acculturation of early agriculture and on the process of establishment of herding society in East Asia

MIYAMOTO Kazuo
(Kyushu University, Faculty of Humanities, Professor)

Research Project Number：19H05593　Researcher Number：60174207
Keyword：Secondary agricultural societies, Herding societies, Environmental change, Immigration, Language spread

【Purpose and Background of the Research】

Prehistoric societies in East Asia consisted of the following four areas: agricultural societies (Chinese mainland), secondary agricultural societies (northeast Asia, southwest China), and herding societies (northern Asia). Among these, temporary cooler and drier climatic conditions triggered the cultural spread and acculturation of secondary agricultural societies in northeast Asia. On the other hand, it is believed that herding societies in the western part of Eurasia became established in areas where agriculture had originally spread due to these cooler and drier climatic conditions. However, little progress has been made in research on how agriculture spread to the Great Wall Region and Mongolian Plateau in East Asia. Therefore, there is a need to clarify the processes by which herding societies came into being as result of cooler and drier climate conditions around 3000 BC. In addition, there is also a need to determine whether herding societies developed from agricultural societies as in the western Eurasian grassland area, or the movement of herding people to the Mongolian Plateau from the middle Eurasian grass land area.

【Research Methods】

We should understand the process of spread or rice agriculture in East Asia in terms of secondary agricultural society. In this case, an original culture of rice agriculture existed, such as unique agricultural stone tools, small rice paddy fields with foot passes and temperate Japonica, which is different to that of the original location in the lower and middle Yangtze River basin. It is probable that these agricultural cultures were established in the eastern Shandong Peninsula. The occurrence of cooler and drier climatic conditions around 3000 BC caused extensive damage on the Shandong Peninsula, probably triggering the production of small rice paddy fields with foot passes and temperate Japonica more suited to the cooler environment. The results of boring core and phytolith analysis carried out at Yanjiaquan Site, Qixia Prefecture, Shandong Province suggest that the Longshan culture probably had rice paddy fields. We will conduct excavations at Yanjiaquan Site to measure and analyze the DNA of charred rice grains in order to elucidate the processes by which small rice paddy fields with foot passes and temperate Japonica were established. And we will also make clear the processes by which domesticated grains spread through the analysis of the kernel stamps of pottery. On the other hand, in order to understand how herding societies became established from early agriculture in northern Asia, we will clarify changes in subsistence activities between the Neolithic and Bronze ages in the Mongolian Plateau by examining dietary changes through the C13 isotopic analysis of human bones. We will excavate at burial cemeteries dating to the Neolithic or early Bronze Age to collect human bones for research on the Mongolian Plateau. Research on the musculoskeletal stress markers (MSMs) of humans proves the existence of differences in subsistence activities during this transitional time. In addition, physical anthropological research and strontium isotopic analysis of human bones will serve to elucidate human movements during prehistoric times.

【Expected Research Achievements and Scientific Significance】

By comparing secondary agriculture in northeast Asia and herding societies in northern Asia, we will shed light on original aspects of human history in East Asia which differ to those of Europe and West Asia. This research will provide insights into the background behind the establishment of independent ancient states in each area. In addition, we will also seek to provide an understanding of human movements and the spread of language groups in the prehistory of East Asia.

【Publications Relevant to the Project】

Kazuo Miyamoto. Early Agriculture in North-east Asia and the Origin of the Yayoi culture. Douseisha Press: Tokyo, pp.311, 2017 (in Japanese).
Kazuo Miyamoto ed. Excavations at Emeelt Tolgoi Site: The third Report on Joint Mongolian -Japanese Excavations in Outer Mongolia. Kyushu University, pp.87, 2018.

【Term of Project】 FY2019-2023

【Budget Allocation】 70,700 Thousand Yen

【Homepage Address and Other Contact Information】

Under construction

Title of Project： Development of speech communication and its correlates of brain, cognition and motor system: A longitudinal cohort study of typically and atypically developing infants

MINAGAWA Yasuyo
(Keio University, Faculty of Letters, Professor)

Research Project Number：19H05594　Researcher Number：90521732
Keyword：Autistic spectrum disorder, Language acquisition, Social cognition, Functional connectivity, fNIRS

【Purpose and Background of the Research】

Autistic spectrum disorder (ASD) is characterized by difficulties with verbal and social communication. Previous studies on cognitive neuroscience have pointed out that ASD primarily involves problems with brain function, in particular with brain connectivity. Although it is assumed that this difference in functional brain connectivity is expressed from an early developmental stage, there is hardly any studies examining both the typical and atypical development of language, social functions, functional brain connectivity and activities in the first year of life.

This study aims to reveal the longitudinally evolving characteristics of brain function development, including functional brain connectivity, various perceptions, cognitions, and motor abilities in infants who are at risk for ASD (risk infants) and typically developing (TD) infants (Figure 1). The purpose of this project is to clarify (1) how these developmental characteristics are involved in the acquisition of language communication, and (2) which developmental characteristics predict future developmental disorders.

【Research Methods】

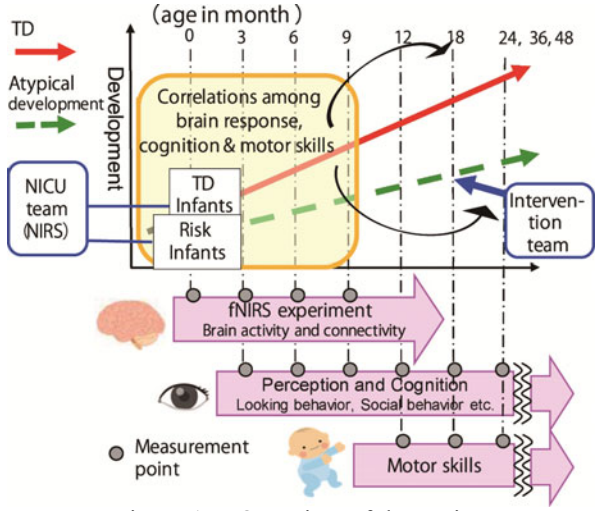


Figure 1.　Overview of the project

The cohort consists of two groups, namely risk infants (siblings of ASD or very premature infants) and typically developing infants. Their brain function, cognitive functions, and motor abilities will be measured longitudinally every 3 or 6 months until 3-4 years-old. Since this study aims to continue and develop the small-scale cohort of the previous project (Kiban A), this study, as in the past, consists of 3 types of experiments: (1) brain function tests using fNIRS (speech and social stimuli), (2) tests for various cognitive functions using behavioral methods (e.g. eye tracking, tests for fine and gross motor skills), (3) developmental examinations and questionnaires. We will develop new analysis methods for the brain function data and motor skill data. In particular, the motor data involves the use of the latest image engineering techniques to quantify and evaluate the data and is modeled by applying deep learning to the large-scale data sets obtained. While conducting this study, a system will be in place to appropriately evaluate and intervene when necessary should participating infants develop language or other problems.

【Expected Research Achievements and Scientific Significance】

From objective (1), it will be possible to explain the relationships between motor skills and social cognitive abilities and how these relationships are involved in language acquisition and development. This will not only illustrate the cognitive neuroscience basis behind language development but will also provide important insights into the specificity and universality of human language. We will also elucidate the mechanisms behind the communication disorder in ASD and provide insights into the intervention methods. Objective (2) will be significant in that it will provide adjunct indicators to help with the early detection and diagnosis of ASD.

【Publications Relevant to the Project】

・Arimitsu, T., Minagawa, Y* et al. (2018) The cerebral hemodynamic response to phonetic changes of speech in preterm and term infants: The impact of postmenstrual age. *Neuroimage: Clinical*, 19: 599-606.
・Liang, Z., Minagawa, Y. et al. (2018) Symbolic time series analysis of fNIRS signals in brain development assessment. *Journal of Neural Engineering* 15(6): 066013.

【Term of Project】FY2019-2023

【Budget Allocation】147,300 Thousand Yen

【Homepage Address and Other Contact Information】

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