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Krithika Shrinivas April 10, 2023

Stone Tools and Sociality: Potential Effects of Conversation and Hobbies on Lithic Quality

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An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
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Abstract

Stone Tools and Sociality: Potential Effects of Conversation and Hobbies on Lithic Quality

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Stone tool making is an inherently social process that has allowed for the transmission of ideas, culture, and the development of human cognitive capacities. This study explored the impact that sociality has on the quality of stone flakes produced through the observation and analysis of conversation that occurred between participants and their instructor during three 30 minute Oldowan style knapping sessions. Participant hobbies based on a self-assessment were also considered in relation to lithic efficacy. The conversational patterns of 15 adult participants were recorded using an ethogram in order to determine whether the initiator of conversations, durations of silence, and questions asked by participants had a bearing on the lithics generated. Each participant was given a score on a sociality index ranging from Minimally Social (1) to Strongly Social (5) based on their proclivity for socializing. Participants were assigned to 3 groups based on their reported hobbies: a fine motor activity group (Group 1), a physical activity group (Group 2), and a group that allegedly did not engage in physical activity (Group 3). The social behaviors and hobbies were correlated with the reduction intensities of participants' cores in order to assess the impact that these variables had on the quality of flakes yielded using bivariate correlations, ANOVA, and t-tests on SPSS and Excel. Reduction intensity is a measurement for how much the core was reduced through the knapping process and serves as a proxy for efficient flake removal. It was found that metrics of sociality and hobbies had no significant effect on lithic quality. However, general trends pointed towards participants who engaged in less conversation having better knapping outcomes, suggesting that socialization may have served as a source of distraction. Despite this, the findings also revealed that learning occurred over the three sessions with drastic increases in reduction intensity on average between the first and third session among most participants. Given the small sample size and short duration of this study, more research must be conducted in order to better understand the effects of sociality and hobbies on lithic quality.

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INTRODUCTION

This project aims to explore the inherent sociality that underpins the process of stone tool making through the observation and analysis of conversation. In particular, stone tool making lends itself to conversation through instruction and socialization between those involved in the process that not only ensure that the task is successfully completed, but also allows for an exchange of knowledge and ideas. Over the past year, my work in Dr. Stout's lab has involved measuring Oldowan stone flakes created by novice knappers in a 30 minute stone tool making task along with watching and coding video data using a social ethogram for graduate student Megan Beney Kilgore's dissertation. My project serves as an extension of Dr. Stout and Beney Kilgore's work by addressing the following objectives: (1) investigating how the nature and content of conversation between two subjects (i.e. participant-participant or participant-instructor) can affect the quality of Oldowan style lithics produced and (2) examining how factors such as the hobbies of participants can influence the conversation that takes place during the knapping exercise and ultimately influences the stone flakes created.

One of the earliest forms of material culture, stone tool technologies have played a crucial role in the daily lives of ancient hominin species. They have used them for a broad range of purposes, primarily associated with nutrient intake, such as hunting (Venditti et al., 2019; Wilkins et al., 2012; Lombard et al.,2005), removing meat off the bones of animals (Braun et al., 2016; Venditti et al., 2021), food processing (Dubreuil and Nadel, 2015; McClatchie et al., 2019; Bekiaris et al., 2020; Field et al., 2020), and nut cracking (Matsuzawa, 2011; Bril et al., 2012; Goren-Inbar et al., 2002). Through comparison with modern human correlates and because of a reconstruction of how we believe stone tools were made, we can hypothesize that ancient hominins would have had the capacity for cognitive executive functioning. As a result, studying stone tool making has the capacity to shed light on the cognitive abilities (Stout 2002; Stout et al., 2011; Malafouris, 2021; Muller et al., 2022) and behaviors (Ambrose, 2010; Marzke, 2013; Kivell, 2015) of early humans. Doing so also allows archaeologists to pinpoint hallmarks of human lineage, trace human evolution, and understand the biological factors that may have shaped these behaviors (Schick and Toth, 2018). Although we cannot directly examine the behavior nor neural activity of extinct hominin species, observing modern humans creating stone tools during knapping tasks can provide archaeologists, anthropologists, and researchers among

others with a glimpse into the way ancient hominins may have behaved and exercised their cognition (Muller et al., 2017; Wynn, 2016; Pargeter et al., 2020).

In particular, stone tool making is also telling of the way early humans may have developed and transmitted language, particularly as a means of facilitating and teaching during the knapping process (Cataldo et al., 2018; Morgan et al., 2015; Shilton, 2019). The use of spoken language as a mode of instruction has been found to be a more efficient mode of teaching and communicating information compared to non-teaching conditions such as imitation-emulation strategies (Morgan et al., 2015, Lombao et al., 2017). Previous studies have demonstrated that knappers receiving verbal communication, compared to gestural or imitation-emulation teaching styles, knapped a higher number of consecutive flakes and were second to expert knappers in exploiting cores more fully (Lombao et al., 2017). Additionally, there is significant overlap of brain activity in Broca's area during language production and stone tool making (Higuchi et al., 2009), potentially making the latter attributable to the development of language. Thus, it is important to study the correlation between stone toolmaking and language in order to understand how cultural transmission could have occurred in early hominins and to analyze the impact that conversation (or lack thereof) has on the course of the knapping process.

BACKGROUND

Oldowan stone tools

Oldowan stone tools were a widely used archaeological style of tools in prehistory, and are largely regarded as being one of the earliest types of stone tools to have ever been produced (de la Torre, 2011) by the early human species, *Homo habilis*. These stone tools are characterized by three distinct features: a point of percussion, bulb of percussion, and platform length (Reti, 2016). Knappers repeatedly strike an unmodified core using a hammerstone to generate flakes, with the point at which the core is hit that results in the production of flake being defined as the point of percussion. The bulb of percussion is the bulge of the flake that emerges from the point of percussion as a result of the force exerted in creating the flake. The platform length is the lateral distance from one edge of the flake to the other. It is speculated that both Oldowan flakes and the core they originate from served as useful tools to early human societies who may have used them to cut up dead animal carcasses and for food processing respectively (Toth and Schick, 2018; Forrester 2020; Wynn et al., 2011).

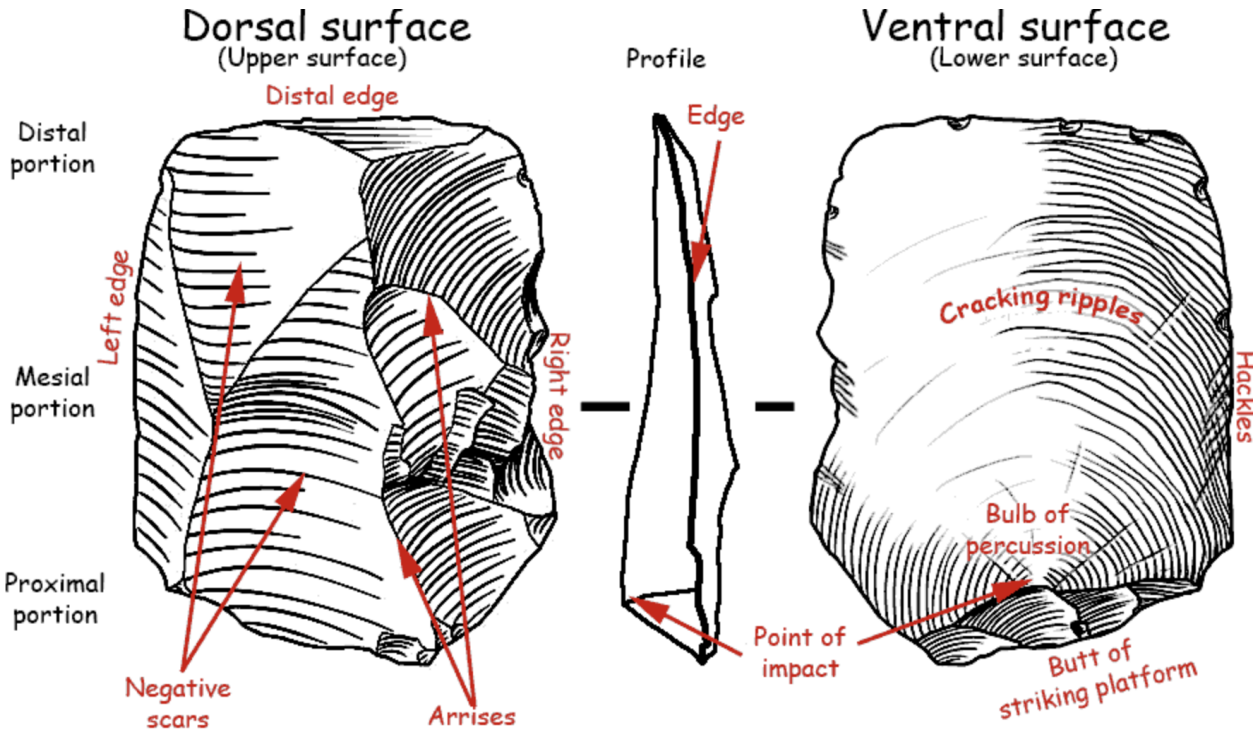

Figure 1. Flake morphology (Alvarez, 2006)

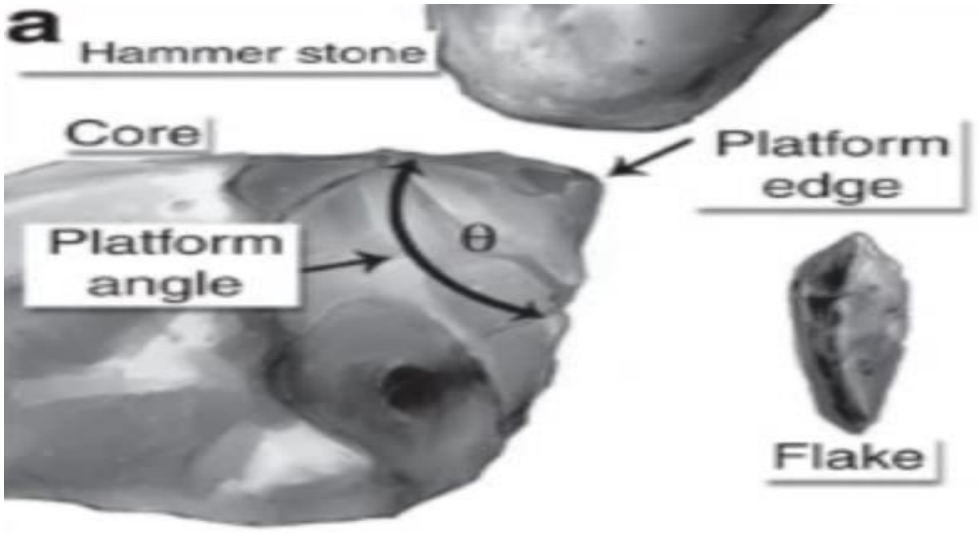

Figure 2. Oldowan stone tool features (Morgan et al., 2015)

Why Oldowan?

For this project, participants recruited to the study were asked to partake in five, 30 minute sessions of an Oldowan-style stone tool making task. Compared to the stone tool industries that followed it, Dr. Stout and Beney Kilgore found Oldowan tools to have a high level of teachability to participants. They also hypothesized that language capacities were really starting to emerge in the hominin line around the advent of the Oldowan tool, which was a compelling reason to use tools of this industry (Pargeter et al., 2022). Furthermore, Oldowan tools are generally characterized by their relative simplicity and straightforwardness, making them an appealing option. For instance, unlike the Acheulean technology, Oldowan tools do not require the core to be prepared prior to knapping nor are they characterized by bifacial cutting edges (Forrester, 2020), which a novice knapper may struggle to shape. Similarly, Oldowan tools differ from artifacts of the Levallois industry as they do not have to pre-determine the flake shape they are trying to achieve (Eren and Lycett, 2012), nor are they like the Solutrean tool which requires fine work to be reshaped in a certain fashion (Schmidt, 2015). Consequently, the stone tool making activity centered on the creation of Oldowan tools is a suitable task for novices to stone

tool production due to its straightforwardness and the relative lack of precision and forethought needed to create them.

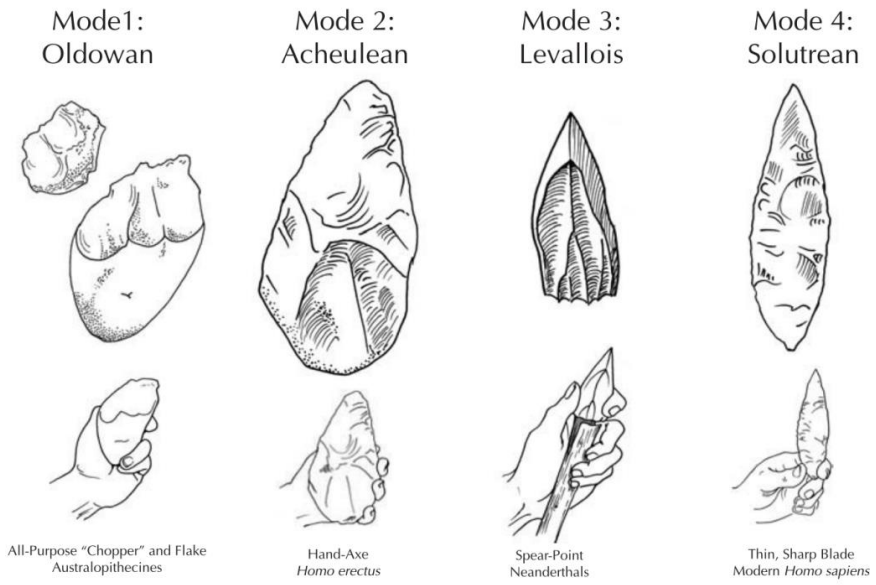

Figure 3. Different styles of stone tools. (Fitch, 2010 as cited in Reyes-Centeno et al., 2018)

Sociality: The Collective Nature of Archaeology

Stone tool making is inherently a social process that is hypothesized to have contributed to the emergence and evolution of language (Cataldo et al., 2018; Ruck, 2014; Stout, 2008; Pain, 2022; Vandervert, 2020) and serves as a means of cultural transmission (Tennie et al., 2017; Lycett, 2019; Luncz et al., 2015; Stade, 2017). Previous studies have shown the activation of Broca's area, a region in the frontal lobe of the brain concerned with speech production, during an Oldowan stone tool making task, indicating the possibility that stone tool making may have favored adaptations for language capacities, leading to the evolution of language (Greenfield, 1991; Stout, 2007; Steele et al., 2012). The co-evolution of tool usage and language suggests that an increase in the complexity of language correlates with more advanced stone tool technologies and vice versa (Ambrose, 2010; Stout and Chaminade, 2009; Putt et al., 2014), highlighting the closely intertwined relationship of stone tool making and language (Ruck, 2014). Alongside language, evidence of cultural transmission is a possibility in the archaeological record with the

development of new technological industries, particularly among the Acheulean, although the extent of cultural variation among the Oldowan industry does remain an ongoing debate (Stout, 2011). The ability of humans to socially transmit information, ideas, values, and cultures to one another has facilitated the development of cumulative culture, advancing human cognition and social learning (Tennie et al., 2017).

Hobby and Demographic details

Hobbies are an important factor in the knapping process, as they render individuals with unique skill sets that may give them an advantage. Participants in this study informed the instructor of the hobbies that they enjoy, whether they engage in sports or any sort of regular physical activity, the duration of time they have taken part in the sport or physical activity, and any prior experience they have had with stone tool making through a self-assessment. Previous studies have found that people with extensive experience in gross motor crafts such as carpentry and pottery demonstrated a stronger initial performance (Hecht et al., 2023), which is why hobbies were considered as a variable of interest. Additionally, all participants took a grip strength test which entailed squeezing a hand dynamometer for 5 seconds in order to receive a grip value. These values were recorded on the self-assessment survey along with the other aforementioned information. The purpose of the grip strength test is to serve as a proxy for overall upper body strength in order to evaluate whether this has any bearing on participants' ability to knap high quality flakes. All of these measurements will help identify whether the participant's innate demeanor, their familiarity with activities that emphasize hand strength, their physical fitness, and overall lifestyle choices have an impact on the flakes they produce.

Novel contributions to the field

Unlike other studies in this field, this project distinguishes itself in its exploration of how the topics of conversation along with how factors closely related to an individual's identity such as their hobbies are connected to their ability to knap effective stone tools. While other studies explore the role that speech plays in instructing subjects on how to produce stone tools (Cataldo et. al, 2018), they fail to explore and regard how language can be studied as a social binding agent that can bring people together, shape their interactions, and in turn affect the quality of flakes produced. For instance, it is possible that regular conversation between two participants or

the instructor and a participant during the knapping session may allow participants to bond with the other subject. This in turn may uplift said participant, and potentially inspire them to put forth more effort in the task to create better flakes.

KEY TERMS

Stone tool: An early form of material culture used by ancient hominins that provide insight into the way ancient hominin species lived and interacted with their environment. The earliest evidence of these tools were found approximately 2 mya

Core: A piece of stone that undergoes lithic reduction to form flakes

Percussion: The act of applying force onto a core using a hammerstone to create a flake

Flake: A portion of stone that is removed from a core as a result of percussion

Hammerstone: A stone tool used to strike off flakes from the core

Oldowan: A widespread stone tool archaeological style from the early Paleolithic era, found about 2 mya, making it one of the oldest archaeological styles. Typically made through percussion

Sociality: As defined in this article, sociality is the inclination to engage in conversation, as is measured by a sociality index in the context of this study

Social transmission: The transfer of information, typically through the use of language in humans, between two individuals

Ethogram: A record of behaviors and activities a particular species may perform

OBJECTIVES AND HYPOTHESIS

This project asks the overarching question of "how do sociality and hobbies influence stone tool production?". This is addressed through the following objectives, as outlined below:

Objective 1: To investigate how the nature and content of conversation between two subjects (i.e. participant-participant or participant-instructor) can affect the quality of lithics produced

Although ancient hominins knapping stone tools and their social interactions while doing so cannot be studied, modern humans are an appropriate substitute to understand the stone tool making process and the sociality that underpins it. This can help archaeologists gauge whether conversation, such as instruction or socialization, and the connections formed as a result of it, were factors that either propelled or hindered knappers from creating stone tools of a high quality.

Objective 2: To understand how factors such as the hobbies of participants can influence the conversation that takes place during the knapping exercise and ultimately influences the stone flakes created

Studying elements such the hobbies alongside the sociality exhibited by participants in relation to the quality of lithics produced provides a more well-rounded and comprehensive picture into the traits that influence a knappers' outcomes. Moreover, gaining more insight into hobbies of a participant sheds some light onto their inclination for socializing, and how this in turn may affect the quality of their flakes.

Hypothesis: It is plausible that participants with higher degrees of sociality (i.e. a propensity to engage more in conversation, ask more questions) will produce more effective lithics. I hypothesize that participants who ask more task related questions and socialize more with their co-participant or the instructor are more likely to make stone tools that are superior in quality. Furthermore, I predict that participants with hobbies that require more hand-eye coordination or emphasize manual dexterity will have better knapping outcomes.

METHODS

This project builds on the work of Dr. Stout and graduate student Megan Beney Kilgore with a specific focus on the social behaviors that characterize the stone tool making process among adult knappers. While Beney Kilgore's original project was also centered on the data of novice child knappers, I chose to focus this project exclusively on young adults and adults due to the incoherence of the audio in the video data for the children. A literature review was conducted to explore the work already done in the field to corroborate and substantiate the assertions made in this paper.

Experimental Set-up of Beney Kilgore's Work

A group of 49 participants were selected for Beney Kilgore's dissertation research. Participants were asked to engage in a 30 minute Oldowan knapping task over the course of 5 days, although only the first, third, and final day were examined for the purposes of this study. The sessions took place in the Paleolithic Technology Laboratory at Emory University. Due to availability of participant scheduling, knapping sessions were conducted either one on one or in groups, ranging from 1 to 5 other participants. Participants were asked to complete a self-assessment detailing information on their demographics and hobbies, and took a grip strength test at the beginning of the study. They were given 3 basalt cores and a hammerstone in order to carry out the Oldowan knapping task. They were provided with verbal instruction by the instructor on how to strike the core with the hammerstone in order to create flakes, although the objective or purpose of executing the task was not clearly and uniformly communicated. After reducing their core to a size that was small enough that participants no longer felt comfortable working with it, they were asked to bag the final core and its associated flakes into ziploc bags to be collected at the end of every session. Participants were expected to knap all 3 cores every single day, or at least engage in knapping for 30 minutes, whichever outcome were to come first. Participants were free to ask the instructor any questions pertaining to the task during the course of the knapping, and the instructor would provide assistance accordingly.

Teaching Approach

The same instructor was present during all the knapping sessions that took place, relaying directions and offering assistance. The instruction consisted of a brief dialogue by the instructor

on what the hammerstone and core were, how the process of knapping worked, and how flakes and their respective cores must be bagged upon completion of the task. The instructor knapped their core alongside every student to serve as a visual model of proper knapping practices. The instruction relayed was non-uniform, with different participants receiving varying information on the task. For example, the instructor offered background into the task in certain instances while failing to do so in others. They only relayed information on the objective of the task, motivations behind the experiment, and the ideal flake type upon participant inquiry.

Participants engaged in solo knapping sessions with the instructor, along with knapping sessions with one or more co-participants, with the number of co-participants present varying for every participant.

Following the instruction, the instructor engaged in naturalistic conversation with the participants. Some participants were more gregarious and the sessions were characterized by a higher frequency of conversation whereas other sessions with more reserved participants were marked by silence. The instructor appeared to express an implicit bias towards quieter participants, because they seemed more reticent to engage in conversations with participants who socialized at the detriment of knapping progress.

Participant Selection for Current Study

A subset of 15 participants were chosen for the current study, divided into 4 groups of 5, 5, 4, and 1 participants based on the hobbies reported in a demographic survey collected by Beney Kilgore. Group 1 included 5 participants who engaged in activities that emphasized fine motor skills and manual dexterity (e.g. sewing). Group 2 included 5 participants with hobbies that indicated frequent physical activity (e.g. participation in a sporting group). Group 3 was composed of 4 participants who expressed that they were typically inactive. Group 4 consisted of one participant who was selected as a potentially interesting outlier with a condition that could possibly influence their knapping outcomes.

The profile of each participant is as follows (see Appendix A for more detailed accounts):

Group 1 participants:

Participant 26: An 18 year old female who enjoys sewing and crocheting

Participant 31: A 20 year old female who enjoys handcrafting

Participant 39: A 20 year old female who enjoys typing and sewing

Participant 27: A 19 year old female who enjoys playing the piano and video games

Participant 43: An 18 year old male who enjoys playing video games

Group 2 participants:

Participant 32: A 19 year old female who hikes and walks 8 hours a week

Participant 34: A 21 year old female who goes to the gym and hikes 2-3 times a week and once a month, respectively

Participant 49: A 19 year old female who has run and played squash since the ages of 10 and 7 respectively

Participant 37: A 19 year old female who does weights and cardio at the gym for 1 hr 30 minutes

Participant 46: An 18 year old male who plays spikeball and goes to the gym 2-3 times a week

Group 3 participants:

Participant 38: 21 year old male

Participant 33: 38 year old male

Participant 48: 19 year old female

Participant 47: 20 year old female

Group 4 (Extra participant):

Participant 25: 21 year old female who is missing a finger and has had surgery to construct thumbs

Ethogram Creation

Following Beney Kilgore's example of a social ethogram in her own dissertation, I created my own social ethogram using the BORIS software that hones in on the intricacies of participants' behaviors and interactions to understand how elements such as the purpose and content of conversation (or the absence of) influenced the quality of lithics generated.

The ethogram is classified into state and point events. State events are those that occur for a certain duration of time, marked by beginning and ending time points, whereas point events are singular events that mark an instantaneous behavior. This series of point and state events can create a nested series of behaviors. My ethogram is divided into the following categories, with subcategories defined by who initiated the behavior:

Knapping Categories:

Knapping (state): Participant is engaging in the act of stone tool creation. (e.g. precussing against the core with the hammerstone)

Socialization Categories:

Socialization (state): A duration of time that is characterized by conversation between an instructor and participant that is unrelated to the stone toolmaking task or the conditions of the experiment,

(IP): initiated by the instructor to a participant (*Example*: *Instructor initiates a conversation on the weather.)*

(PP): between a participant and participant (*Example*: *Participant starts a conversation with another participant on the weather)*

(PI): initiated by participant to the instructor (*Example*: *Participant starts a conversation on the weather with the instructor)*

Experiment Conversation (state): Explanation of experimental procedures and protocol. This type of conversation pertains to the research design and ensures that external and internal validity are upheld.

(IP): initiated by the instructor to a participant (*Examples: Instructor tells the participant to bag their flakes. Instructor tells the participant that they will be given 30 minutes every day to knap.)*

(PP): between a participant and participant (*Example: Participant asks a co-participant where they should place their finished core and associated flakes.)*

(PI): initiated by participant to the instructor (*Example: Participant asks the instructor where they should place their finished core and associated flakes.)*

Task Conversation (state): Group instruction regarding the stone toolmaking task

(IP): initiated by the instructor to a participant (*Example: The instructor provides a rundown of knapping to all the participants in a group session.)*

(PP): between a participant and participant (*Example*: *Participant provides a general overview of knapping to a co-participant.)*

(PI): initiated by participant to the instructor (*Example: Participant discusses knapping with the instructor.)*

Silence (state): A duration of time in which the instructor and participant, or participant and participant, do not engage in conversation

Learning Categories:

Instruction (state): Instructor offers individualized instruction on the stone toolmaking task. *Example: The instructor advises the participant to strengthen their grip on their core or to strike a specific part of their core in order to produce flakes.*

Task Question (point): Participant asks the instructor for help with the task either through a direct question or through an expression of concern

Example: *The participant asks the instructor to suggest possibilities for where they can strike their core.*

Experiment Question (point): Participant asks the instructor questions related to experimental protocol

Example: The participant asks the instructor about what to do with their cores when they are finished knapping them.

I reviewed the self-assessment of participants' hobbies in order to select which participants' videos to watch based on their proclivities for certain activities in order to cover a broad range of

participants and behaviors. The method of selection is described below. Afterward, I watched their video data for days 1, 3, and 5 of the knapping activity and coded the videos on my ethogram. This method of selection lent itself to a case study format, where the behaviors of chosen participants were examined and presented as a means of exemplifying specific behaviors.

The lithic measurement data of the flakes produced by the participants which I helped record last year was consulted to analyze which hobbies, and conversational patterns from the videos correlated with superior flake quality. Grip strength was also examined as a confounding variable. Upon establishing which traits and pursuits were markers of flake efficacy, I ran statistical tests such as bivariate and ANOVA tests using SPSS and Excel to determine the significance of the results gathered.

Sociality Index

Every participant was given a number on a sociality index designed to categorize them based on their proclivity for engaging in conversation with the instructor and/or their fellow participants. The designated number is an average of numbers from their day 1, 3, and 5 knapping sessions. Half numbers are rounded up or down based on the researcher's perception on which category is more appropriate. Along with the ethogram, this index was created with the intention of providing a secondary metric for defining expressed behaviors. I created this index after watching many recorded knapping sessions and noticing concrete patterns across participants' conversations such as long periods of silence, frequent conversation, and occasional remarks. This was categorized on a spectrum from minimal conversation to extensive conversation. It is represented below:

1 Minimally social

The participant only engages in the conversation if they are explicitly addressed and strictly keep to themselves. They only discuss the task at hand and experimental procedure with the instructor if necessary and refrain from socializing with the instructor or co-participant

2 Neutral

The participant mostly engages in the conversation if they are explicitly addressed, but tend to keep to themselves otherwise. They may make occasional remarks that contribute to the conversation, but are not substantial in nature. Their conversational focus is more often than not pertaining to the task at hand and experimental procedure as opposed to socializing with the instructor or co-participants.

3 Slightly Social

The participant socializes with the instructor and/or their co-participant during the knapping session, but to a lesser extent than categories 4-5. They may contribute more to the conversation than they initiate them. They discuss the task, experiment, and/or a combination of all three, but may tend to focus on one category more.

4 Social

The participant is generally engaged in the conversation that takes place during the knapping session. They contribute to the conversations that take place and may initiate them as well. They discuss the task, experiment, miscellaneous topics, and/or a combination of all three.

5 Strongly Social

The participant is a proactive member of the socialization that takes place during the knapping session. They regularly initiate and contribute to conversations, often in a thoughtful and enthusiastic manner. They actively discuss the task, experiment, miscellaneous topics, and/or a combination of all three.

Flake Quality

The lithic debitage participants generated during the knapping sessions were categorized as whole flakes, splits, snaps, or detached pieces based on their morphology. Whole flakes are generally regarded as superior in quality as they have the highest level of utility (Stout et al., 2019). They contain a distinct point of percussion, bulb of percussion, and platform length that can easily be identified. Split flakes are broken vertically across a flake's ventral surface with respect to the point of percussion and contain half of a point of percussion, with the other half being on another split flake. Snaps are flakes that split along the horizontal axis and are quite

rare in this sample, and detached pieces are those that lack the three aforementioned features of a whole flake. The quality of the produced flakes is correlated with the capacity and experience of the knapper, with more experienced knappers producing more flakes from the core (Proffitt et al., 2022), flakes that are larger, and flakes with thinner platforms and cutting edges. By contrast, novice flakes are smaller with bulkier platforms and duller cutting edges (Morgan et al., 2015; Toth et al., 2006) which render them as relatively less effective for use in practical applications (e.g. cutting meat). An example of this is a core split, in which a knapper employs an excessive amount of force when hitting the hammerstone against the core, resulting in a significant chunk of the core, typically half of it, falling off the core; their large size hinders their efficacy.

Lithic Analysis Methods

The following lithic **variables** are used in the analysis:

Reduction Intensity

Reduction intensity is a measurement of how much the core has been reduced over the knapping process, in order to gauge how effectively flakes were produced. It serves as a proxy for efficient flake removal. A smaller final core weight in relation to the original core weight signifies a higher reduction intensity, and therefore efficiency at the removal of flakes. Reduction intensity was used as a measure of flake efficacy instead of other metrics such as lithic measurements, as it is the **simplest measurement** that is reflective of participant skill, as better knappers remove more flakes due to the fact that they are better able to exploit viable platform angles on the core. It is calculated through the following formula:

Reduction Intensity = Beginning Mass (g) - Final Mass (g)

*Reduction Intensity percentage = ((Final Mass / Beginning Mass) * 100) - 100) * -1*

1. **Average Reduction Intensity Percentage per session**

A percentage was taken between the original and final core weight to calculate the amount that was reduced. This was done across all 3 cores in a day, and averaged to produce one value.

It represents participants' learning over the course of the knapping sessions. This is because it allows for comparison in reduction efficiency across the three sessions, such that if participants' reduction intensity increased, so did their knapping skill.

Ex: $\frac{(\text{Day 1 core 1 final \%}) + (\text{Day 1 core 2 final \%}) + (\text{Day 1 core 3 final \%})}{3}$

2. **Reduction Intensity Ratio**

Measurement of how much of the core participants were able to reduce between the first and final sessions. It represents participants' growth between the first and last knapping sessions, making it a strong indicator of change over time. It was calculated by dividing day 5's average reduction intensity percentage by day 1's average reduction intensity percentage to create a ratio.

(Day 5 Average Reduction Intensity Percentage) / (Day 1 Average Reduction Intensity Percentage)

3. **Total Mass Removed (g)**

Measurement of how much of the core participants were able to reduce across the 3 sessions. It represents the participants' comprehensive performance over the course of the experiment by highlighting how many grams out of all their cores were participants able to successfully remove. It was calculated by adding the initial core weights across day 1, 3, and 5 and subtracting this total value from the sum of the final core weights across day 1, 3, and 5.

(original core weights day 1, 3, and 5) - (final core weights day 1,3, and 5)

These measurements are used in order to determine the total amount of core that every participant was able to successfully reduce. Different methods are employed to calculate reduction intensity in order to observe the correlation between the values they yield and the various social metrics being analyzed. These variables tie into the hypotheses being tested in order to gauge lithic efficacy when related to sociality.

Sociality and Hobbies Analysis Methods

The following are the sociality and hobbies related variables used:

Instruction Initiated Total Cases

The total number of times the instructor initiated task or experiment conversation, socialization, and/or instruction.

Instructor Initiated Duration

The total duration of time for which the instructor initiated a task or experiment conversation, socialization, and/or instruction.

Participant Initiated Total Cases

The total number of times the participant initiated task or experiment conversation or socialization.

Participant Initiated Duration

The total duration of time for which the participant initiated a task or experiment conversation or socialization.

Questions

The total number of times the participant asked a task or experiment question.

Group

The group that every participant was designated to based on their hobbies (group 1: fine motor skill activities, group 2: physical activity, group 3: no reported physical activity).

Social Index

Participants were ranked on a social index based on their proclivity for conversation

Silence Duration

The total duration of time for which no conversation took place.

These variables tie into the hypotheses being tested in order to gauge lithic efficacy when related to various dimensions of sociality.

Tests Run

The following lithic analysis tests were run:

Learning over Time Tests

1. **Session vs Average Reduction Intensity Percentage**
   This test assesses the change in average reduction intensity percentage across the 3 sessions. This test gauges whether learning has taken place.

2. **Participant vs Average Reduction Intensity Percentage per Session**
   This test assesses participants' progress with knapping over the course of the 3 sessions. This test tracks the individual growth of each participant.

Sociality vs Lithic Quality Tests

3. **Reduction Intensity Ratio vs Instructor Initiated Total Cases**
   This test assesses the correlation between the amount of times the instructor initiates conversation versus the amount the participant reduced their cores between day 1 and 5.

4. **Reduction Intensity Ratio vs Instructor Initiated Total Duration**
   This test assesses the correlation between the duration of time for which the instructor initiates conversation versus the amount the participant reduced their cores between day 1 and 5.

5. **Reduction Intensity Ratio vs Participant Initiated Total Cases**

   This test assesses the correlation between the amount of times the participant initiates conversation versus the amount they reduced their cores between day 1 and 5.

6. **Reduction Intensity Ratio vs Participant Initiated Total Duration**

   This test assesses the correlation between the duration of time for which the participant initiates conversation versus the amount they reduced their cores between day 1 and 5.

7. **Reduction Intensity Ratio vs Questions Total Cases**

   This test assesses the correlation between the number of questions a participant asked versus the amount the participant reduced their cores between day 1 and 5.

8. **Reduction Intensity Ratio vs Silence Duration**

   This test assesses the correlation between the duration of time when the participant of focus did not engage in conversation versus the amount the participant reduced their cores between day 1 and 5.

9. **Total Mass Removed vs Instructor Initiated Total Cases**

   This test assesses the correlation between the amount of times the instructor initiates conversation versus the amount the participant reduced their cores overall across the 3 sessions.

10. **Total Mass Removed vs Instructor Initiated Total Duration**

    This test assesses the correlation between the duration of time for which the instructor initiates conversation versus the amount the participant reduced their cores overall across the 3 sessions.

11. **Total Mass Removed vs Participant Initiated Total Cases**

    This test assesses the correlation between the amount of times the participant initiates conversation versus the amount they reduced their cores overall across the 3 sessions.

12. **Total Mass Removed vs Participant Initiated Total Duration**

    This test assesses the correlation between the duration of time for which the participant initiates conversation versus the amount they reduced their cores overall across the 3 sessions.

13. Total Mass Removed vs Questions Total Cases

This test assesses the correlation between the number of questions asked versus the amount participants reduced their cores overall across the 3 sessions.

14. Total Mass Removed vs Silence Duration

This test assesses the correlation between the duration of time when the participant of focus did not engage in conversation versus the amount the participant reduced their cores overall across the 3 sessions.

15. Sociality Index vs Average Reduction Intensity Percentages Per Session

These tests analyzed the effect of the sociality index scores on average reduction intensity percentages per session.

Innate Strength vs Lithic Quality Test

16. Grip Strength vs Average Reduction Intensity Percentages Per Session

These tests analyzed the effect of participants' grip strength scores on average reduction intensity percentages per session.

Hobbies vs Lithic Quality Test

17. Group Assignment vs Average Reduction Intensity Percentages Per Session

These tests analyzed the effect of participants' assigned groups on average reduction intensity percentages per session.

Knapping Focus vs Lithic Quality Test

18. Total Mass Removed vs Knapping Total Cases and Duration

This test assesses the correlation between the 1) the correlation between the total number of times knapping was initiated and 2) the total duration of time knapping occurred with the amount the participant reduced their cores overall across the 3 sessions.

19. Reduction Intensity Ratio vs Knapping Total Cases and Duration

This test assesses 1) the correlation between the total number of times knapping was initiated and 2) the total duration of time knapping occurred with the amount the participant reduced their cores between day 1 and 5.

Statistical Tests Employed

A combination of bivariate correlation tests, t-tests, and ANOVA tests were run using SPSS and Excel in this study.

Bivariate correlation tests were used to measure the relationship between two variables. This test was employed to observe the association between two variables, such as reduction intensity ratio and the social index

T-tests were used to examine whether there was a significant difference between two groups, centered around one variable.

ANOVA tests were used to compare more than two means from two independent groups. This was used to examine group differences and the effect of session on performance. An example of this is the test between each participant versus their average reduction intensity percentage per session.

Group 4 tended to pose as an outlier across many of the tests run, leading to their exclusion from the tests in order to increase accuracy.

RESULTS

1. Ethnographic Findings

The participants in the study were young adults and adults. Many expressed a desire to pursue careers in healthcare and academia, in fields such as biology, public health, or anthropology. Most participants were generally reticent at the beginning of the study, yet became increasingly social by the final day. Many conversations tended to revolve around the task or experiment, although as the instructor asked participants more about their personal and academic lives, most were willing to open up about these topics and even ask the instructor about their own life. Popular socialization topics included coursework, career goals, interpersonal relationships, and pets. Participants tended to be more social in one on one knapping sessions with the instructor, as opposed to in group settings, where conversation was mostly minimal. Participants engaged in conversation more with the instructor on average compared to with their co-participants.

2. Lithic Analyses of Performance

Did learning take place over the course of the 3 knapping sessions?

Firstly, whether learning took place over the course of the three days was gauged by analyzing knapping, social, and hobbies-related trends between each session and the average reduction intensity percentage across them. This was done before examining the possible social and hobbies-related factors that may have been responsible for said learning to have occurred.

Session vs Average Reduction Intensity Percentage

A one-way ANOVA revealed that there was a statistically significant difference in average reduction intensity percentage of all subjects between different sessions. $n=15$, $F= 20.416$, $p<0.05$.

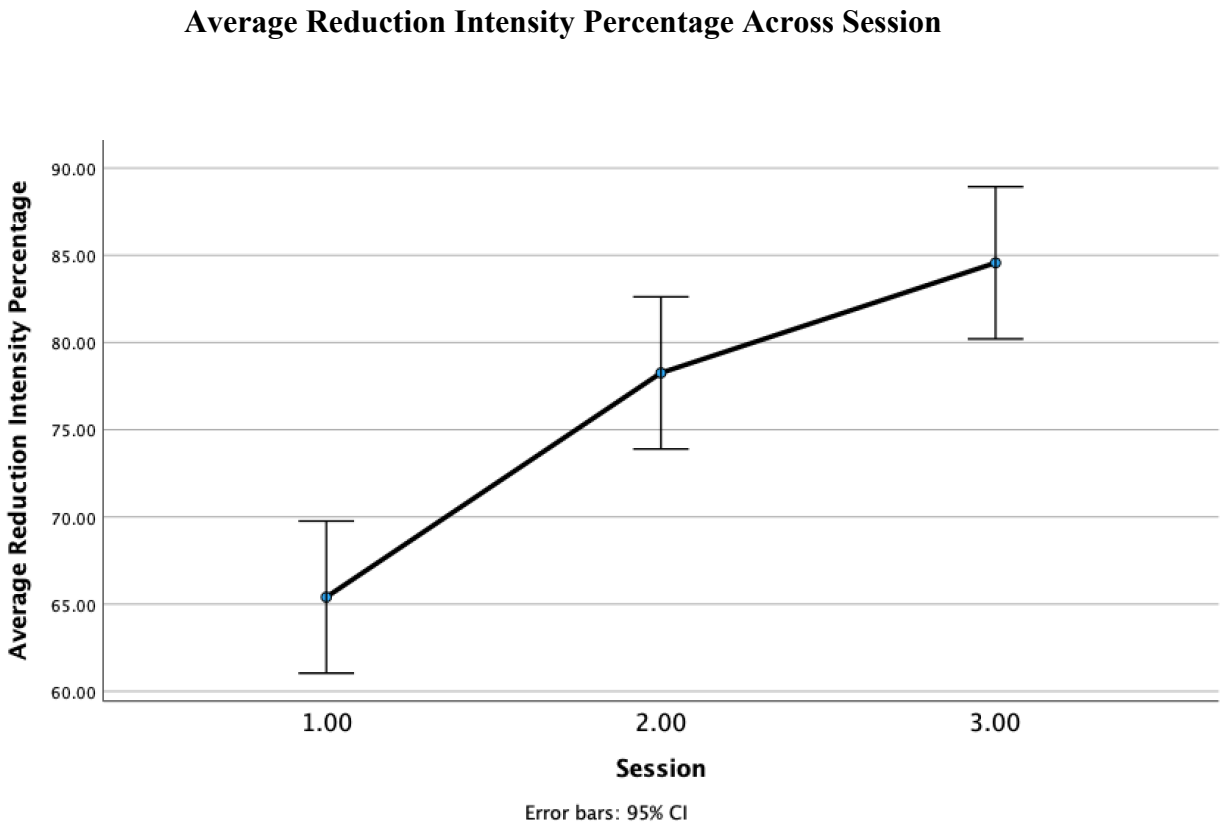

Figure 4. Session vs Average Reduction Intensity Percentage

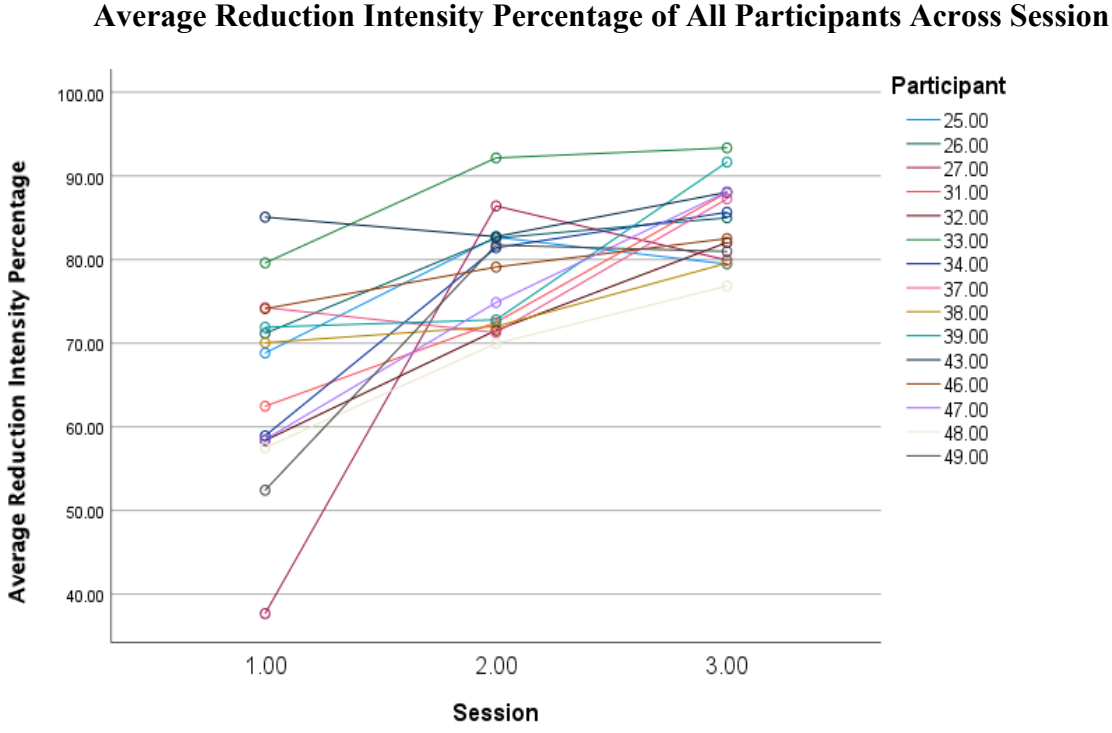

Figure 5. Average Reduction Intensity Percentage per Participant Across Session

Given that learning effects were present, the factors that may have influenced improvement over the three days and performance overall were examined.

As participants learned across the 3 sessions, what factors may have been related to this improvement?

The reduction intensity ratio represents a change in reduction intensity between day 1 and 5. It was found that there were no significant correlations ($p>0.05$), $n=15$, between the reduction intensity ratio and the following metrics:

1. Knapping Total Cases
2. Knapping Duration
3. Instructor Initiated Total Cases
4. Instructor Initiated Duration
5. Participant Initiated Total Cases
6. Participant Initiated Duration
7. Questions Total Cases
8. Silence Duration

What factors may have influenced how participants performed overall?

Participant performance can be examined by studying the difference between the sum of the initial core weight and the sum of final core weights on day 1, 3, and 5.

It was found that there was no significant correlation ($p>0.05$), $n=15$, between the total mass removed and the following metrics:

1. Knapping Total Cases
2. Knapping Duration
3. Instructor Initiated Total Cases
4. Instructor Initiated Duration

5. Participant Initiated Total Cases
6. Participant Initiated Duration
7. Questions Total Cases
8. Silence Duration

How did sociality impact reduction intensity per session?

Sociality, as defined by the social index, was specifically considered across the 3 sessions.

A one-way ANOVA revealed that there was not a statistically significant difference in average reduction intensity percentage across different social index values on session 1. $p>0.05$, $n=14$.

A one-way ANOVA revealed that there was no statistically significant difference in average reduction intensity percentage across different social index values on session 3. $p>0.05$, $n=14$.

A one-way ANOVA revealed that there was not a statistically significant difference in average reduction intensity percentage across different social index values on session 5. $p>0.05$, $n=14$.

One participant was removed from the analysis as they were the only individual within a category, yielding an invalid ANOVA result.

How did grip strength impact reduction intensity per session?

Grip strength was examined as a potential confounding variable in influencing lithic outcomes. It was studied across all three sessions to see if it had a larger impact on certain sessions versus others.

There was no significant correlation ($p>0.05$) between grip strength and average reduction intensity percentage ($n=15$) in session 1.

There was no significant correlation ($p>0.05$) between grip strength and average reduction intensity percentage ($n=15$) in session 3.

There was no significant correlation ($p>0.05$) between grip strength and average reduction intensity percentage ($n=15$) in session 5.

How did group assignment impact reduction intensity per session?

Group was studied alongside the average reduction intensity percentage in order to evaluate the impact that participants' hobbies had on lithic outcomes.

A one-way ANOVA revealed that there was not a statistically significant difference in average reduction intensity percentage across different groups in session 1. $p>0.05$, $n=15$.

A one-way ANOVA revealed that there was not a statistically significant difference in average reduction intensity percentage across different groups in session 3. $p>0.05$, $n=15$.

A one-way ANOVA revealed that there was not a statistically significant difference in average reduction intensity percentage across different groups in session 5. $p>0.05$, $n=15$.

DISCUSSION

Overall, the analyses indicate that over the course of the three knapping sessions, participants' average reduction intensity percentages increased the most between session 1 and 3, while largely stabilizing between sessions 3 and 5 (Fig. 4). This indicates that learning mostly occurred between the first two sessions, followed by diminishing returns between the third and final sessions. It also suggests the potential importance of thorough instruction during the early part of the study to maximize learning outcomes on the third day. Moreover, it was noted that participants who performed better on average on the first day tended to continue with this pattern across the 3 sessions (Fig. 5). Thus, the greatest variability was in initial performance.

With regard to the hypotheses, I predicted that higher scores on the sociality index would correlate with higher reduction intensities. Additionally, I predicted that individuals with hobbies emphasizing fine motor skills (Group 1) would perform better on average in the knapping task. In spite of this, it was found that there is largely **no correlation** between the social metrics and hobbies studied in relation to lithic efficacy. However, it was noted that participant 33, who had a sociality index score of 1, performed the best of all the participants across sessions 1, 3, and 5. While I initially interpreted their lack of socialization as a lack of motivation for the task and assumed that they would consequently have poorer lithic outcomes, their results may indicate that socializing serves as a distraction; it is possible that participants who avoid doing so are able to perform better on average as their focus is exclusively on the stone tool making task.

This points towards social behaviors potentially being detrimental to the production of quality flakes, deviating from other works conducted in the field that emphasize how sociality underpin stone tool making, particularly in researcher-led knapping tasks. For instance, the Higuchi (2009) and Lombao (2017) papers discuss how the presence and absence of language in their respective studies served as a mode of instruction in order to facilitate stone tool making. Papers such as the Ambrose (2010) and Ruck (2014) papers also illustrate the heavily intertwined relationship between stone tool making and language usage, and how language has enabled the creation of increasingly complex stone tools. This demonstrates that these studies have found that language has not only been a catalyst for stone tool production, but has also helped propel human cognition. The findings in this study are more in line with the Putt (2014) paper, which argues

that verbal language had detrimental effects on the production of Acheulean handaxes due to a proclivity to overimitate the instructors. Given the relative ease of knapping Oldowan flakes, a similar outcome raises questions about what elements may have influenced the results of this study.

With that said, the lack of correlation between lithic quality, sociality, and hobbies may be attributed to several methodological or theoretical considerations. The former may entail a small sample size, short duration of research, categorization of social variables that may have prevented significance, the lack of a controlled environment, the lack of uniformity in instruction conveyance, and a varying number of participants per session. To address the first two, **it cannot be concluded** that sociality has no positive impact on lithic quality, as the experiment was composed of a small sample and the study did not last for a long enough time period. This may have failed to facilitate bonding between several participants and the instructor, thus hampering sociality. This serves as an important caveat to arguments raised by the Putt (2014) and Morgan (2015) papers, which also examine the role of language in knapping within a short time frame. Addressing these constraints effectively may create experimental conditions that are more conducive to bonding and thus reveal that sociality has more substantial implications on learning.

Moreover, it is possible that the social categories created may have failed to take into account information pertaining to a participants' sociality that may have positively impacted the quality of their lithics. For instance, this research does not encapsulate the specific content of the conversation that took place (i.e. academics, personal life, etc). Additionally, the socialization that occurs does so in an environment that does not specifically control for conversation. Conversation freely arises and is a byproduct of the knapping sessions as opposed to being carefully planned and executed. Additionally, the lack of uniformity in instruction may have played a role in shaping the results, with certain participants receiving more thorough directions than others. The varying number of participants per session may have influenced the interactions participants had with other participants and the instructor, with group sessions limiting conversation; this may have also had an impact on lithic quality.

With respect to the theoretical considerations, given that sociality, hobbies, nor grip strength yielded significant results, it is possible that there were other potential external variables that may have influenced the findings. Some potential theoretical considerations that may have influenced lithic quality may include (1) personal aptitude, (2) independence, (3) perseverance, and (4) kinaesthetic learning styles. It is possible that a participant's ability to swiftly grasp the nature of the task and execute it influenced their reduction intensity values. Moreover, participants who were more independent and goal-oriented may not have sought the instructor's help as regularly, and may have striven to attain a certain level of perfection in the execution of the task. Participants with learning styles that were more kinaesthetic in nature may have also performed better, as the instructions for the task were relayed through a combination of visual and auditory stimuli alongside a tactile activity.

Further research in the field may implement the aforementioned methodological and theoretical considerations in order to assess potential variables that influence lithic quality along with the role of sociality in the practice. For instance, as participant 33, with a social index score of 1, performed the best across days 1, 3 and 5, future studies can encourage instructors to exclusively center their dialogue on task or experimental protocol and limit their socialization in order to gauge if a lack of socialization explicitly has an impact on the lithics. As the findings suggest that participants who performed better over the three knapping sessions were above the curve on day 1, this may indicate that more thorough instruction is necessary to account for participants with various learning styles. Powerpoint presentations, videos, diagrams, or audio recordings may be incorporated to examine if these measures can improve lithic quality. Participants may also be requested to take an aptitude test, DISC assessment, or Enneagram test. The DISC assessment is a personality test used to determine an individual's inclination towards the four DISC factors: dominance, influence, steadiness, and compliance. The results are used to improve productivity and communication, often in workplace settings (Beedu, 2021). Similarly, the Enneagram test examines a person's core values, motivations, strengths, and weaknesses and categorizes these into nine personality types, including "the perfectionist" and "the observer" (Sutton et al., 2013). These tests may be used to assess whether qualities such as skill, independence, and perseverance may affect lithic efficacy.

In spite of the findings diverging from previous archaeological studies, they are among the first in the field to specify the role of participant-led social behaviors in knapping efficacy and also to explore the role of participant hobbies in their knapping outcomes. Examining these factors is important, as they may provide more insight into the experiences and skills that may render participants an advantage in knapping Oldowan style stone flakes.

Appendix A

Ethnographic Accounts

This appendix includes the specific ethnographic accounts of each participants' unique socialization tendencies, demeanor, and goals as expressed in the videos, which may have bearing on their knapping outcomes. These accounts were used in assigning sociality index numbers.

Group 1 participants:

Participant 26

Sociality Index Number: 4

The participant is generally cheerful and has an easy going demeanor. On the first day, they ask several questions about the task at hand, the scope of the experiment, the rationale behind the experimental design, and the Oldowan stone tool industry and its origins. On days 1 and 3, they engage in minimal conversation and remark on statements made by their co-participant. While this continues into Day 5, they grow increasingly comfortable in making conversation with their co-participant throughout the 3 days, and also with chatting with the instructor. Despite this, participant 26 appears generally quiet and focuses on the task at hand throughout the 3 days. This observation may be in light of their co-participant being extremely talkative.

Participant 26's focus on the task and motivation to learn more about the experiment's implication may have been responsible for them having the highest reduction intensity percentage on day 1, and superior outcomes across day 3 and day 5.

Participant 39

Sociality Index Number: 3

On the first day, the participant was very quiet and did not socialize frequently with the instructor except for the occasional quip. The instructor initiated the main socializing event when they asked the participant about their time performing in the circus, to which the participant briefly described their experience. The participant asked many questions pertaining to the task and experiment and received ample instruction. Their session was largely characterized by silence and many pauses between consecutive knaps. On days 3 and 5, the participant appeared

to have warmed up to the instructor more, and was more willing to express themselves, share their feelings, and slowly reveal aspects of their personality. The conversation mainly revolved around the task and the experiment, but pertained to miscellaneous topics as well provided they were initiated by the instructor.

Participant 39 showed drastic improvements between day 3 and 5, suggesting that their conversations with the instructor on day 3 proved to be more beneficial than those on day 1 in improving their lithic outcomes.

Participant 27

Sociality Index Number: 4

On the first and third days, the participant was generally quiet. Their questions revolved around the task and they had several questions about the experiment, its origin, and stone tools as a whole. They were very polite and respectful in their interactions with the instructor. The instructor mainly initiated socialization attempts with the participant. On the last day, the participant significantly opened up to the instructor, revealing several aspects about themselves which illuminated their personality. They talked about their family, wanting to get a pet, and expressed genuine enthusiasm about the knapping task and stone tools. They actively initiated conversation with the instructor, often more than the instructor themselves and asked the instructor many questions about their personal life.

Participant 27 struggled with the task during the first session, yielding the lowest average reduction intensity percentage. They expressed a lot of reluctance on the first day, which may have contributed to this result. Their dramatically improved performance on day 3 is reflective of their concerns being addressed by the instructor on day 1, and perhaps a result of their motivation to learn more about how to properly execute the task. The numerous conversations they initiated on day 5 served as a deterrent to their average reduction intensity percentage on day 5, which declined from day 3.

Participant 43

Sociality Index Number: 3

The participant was generally good-natured and polite. They expressed a desire in pursuing biology in graduate school or owning a business. The instructor and participant also discussed the participants' roommate who was presumably another participant in the study. On the first day, the participant complied with a common trend in the study, where participants are reticent in their socialization on the first day. They responded to the instructors' attempts to socialize but are generally reserved and do not initiate conversation very frequently. On the third day, the participant opens up significantly and appears very comfortable with the instructor and their co-participant, even asking the instructor to take a picture of them with a stone flake. Surprisingly, however, on the final day, the participant reverts back to keeping to themselves. While they initiate conversation a few times, the conversation is almost always an offshoot of the instructors' attempts to socialize. The instructor frequently starts conversations with the participant, who largely did not keep the conversation going.

Participant 43's quietness on the first day allowed them to focus on the task and yield better outcomes on day 3, proof of their learning on day 1.

Participant 31

Sociality Index Number: 2

The participant was a sophomore at Emory at the time of their knapping session. They were majoring in Neuroscience and Behavioral Biology and considering a double major in Quantitative Science with the goal of applying to graduate school. They expressed an interest in research in the fields of child psychology and development. On day 1 and 3 of the knapping sessions, the participant was a part of group sessions and does not speak unless spoken to. They keep to themselves and are focused on completing the task. However, as day 5 of their knapping session was one on one with the instructor, they opened up to the instructor dramatically, conveying information about their academic and personal life. The participant also initiates several conversations with the instructor about the experiment, task, and their own personal and academic life. They contribute thoughtfully to questions asked of them as well. In spite of them ranking highly on the sociality index on the final day, their propensity to socialize on days 1 and 3 put them lower on the scale.

Participant 31 shows consistent improvement across the 3 days, perhaps as a result of the silence enabling them to focus closely on the task. Their interest in child psychology may have influenced their motivation for the task, as the instructor discussed the role of children in their study.

Group 2 participants:

Participant 32

Sociality Index Number: 3

The participant is a pre-med student at Emory, who at the time was a sophomore. They were involved in cancer biology research and expressed an interest in global health, especially through the coursework they discussed. They seemed genuinely curious about the experiment and asked several questions on its implications. Given the group nature of the first day, the participant was quiet and did not engage in much conversation, but seemed to gradually open up on the third day and grew increasingly jovial and informal in their speech, and also more willing to initiate conversation with the instructor and even another participant to an extent on the last day. The instructor and the participant even appeared to share an inside joke. The prospect of being filmed made them a bit nervous, which could have possibly hindered some conversation.

Participant 34

Sociality Index Number: 3

The participant is a pre-med student who transferred to Emory from another university. On the first day, she was reserved, mainly only talking when the instructor initiated conversation on the task or other topics. This could be attributed to the knapping session being conducted in a group. On the third day, the participant remains quiet but converses more with the instructor as there is only one other participant in the knapping session. The instructor and the participant particularly bond over the fact that they are both from the same region in the country. On the final day, the participant continues to remain silent for the majority of the session, but is slightly more at ease with the instructor. They initiate conversation regarding the task and experiment, and answer the instructors' questions. Nonetheless, their initiation of conversation is rare and sporadic with the instructor still carrying the conversation that takes place.

Participant 37

Sociality Index Number: 2

Participant 37 is mostly quiet and keeps to themselves for the duration of all three of their knapping sessions. Their socialization with the instructor is mainly a result of the instructor's initiation, through which it is learned that they were a pre-business student at Emory at the time of their knapping sessions. Their attempts to initiate conversation mainly revolve around the task and the experiment. They express a determination to execute the task properly, and ask the instructor several times for suggestions on how they could better approach the knapping exercise in order to reduce the core more effectively.

Participant 46

Sociality Index Number: 5

The participant was a pre-med student at Emory who is from Georgia. They attended a high school in a different state and were a freshman at the time of the knapping session. They are friendly and good-natured. The participant talks at length about the task, actively socializes and initiates conversation with the instructor. Their actions reflect a diligence to complete the task accurately and with precision, often seeking out the instructor's help. On the first day, the participant is most talkative and regularly interacts with the instructor. On the third day, this tendency slightly decreases, perhaps due to the participant's increasing familiarity with the task. Nonetheless, they still initiate conversations and thoughtfully respond to the instructor's questions. On the last day, the participant is more quiet and focuses on the task. They ask the instructor a question pertaining to the task and respond to their questions and attempts to socialize. They also had a co-participant, whom they initiated a conversation with, unlike the co-participant who did not lead any conversations with the participant. The group nature of the final knapping session may have hindered the participant from communicating more proactively with the instructor compared to the previous two days, yet their effort to do so in spite of the group setting was noted. Overall, the participant expressed enthusiasm at the prospect of knapping, and this grows throughout the three days.

Participant 49

Sociality Index Number: 5

The participant joined the study as per the recommendation of another participant in the study, implying that they were most likely a freshman at the time of their knapping session. The participant has a very positive and sociable demeanor. They initiate many conversations with the instructor that suggest a genuine interest in getting to know them and their life. For instance, they ask about the instructor's experience with teaching at Emory, their career goals, their dissertation, and weekend plans. They also ask questions about anthropology courses at Emory, indicating that their time spent with the instructor may have piqued their interest in the field. While the participant does not talk as much during their knapping session when a co-participant is present on day 5, they are relatively more social than other participants during their respective group knapping sessions. They also initiate conversation with their co-participant, which has been a rare occurrence in other videos. These factors made this participant stand out.

Participant 49 showed a higher level of improvement between day 1 and 3 versus day 3 and 5. This may indicate that the presence of a co-participant may have affected their performance.

Group 3 participants:

Participant 47

Sociality Index Number: 5

The participant was a junior at Emory at the time of the knapping sessions. From the first day, they appeared very warm and sociable in their interactions with the instructor and were keen about the task. Their dialogue suggested a dedication to successfully execute the task and produce quality flakes. Although the instructor mainly initiated the conversations on the first day, the participant was eager to engage and responded thoughtfully to the instructors' questions and comments. Over day 3 and day 5, the participant started the conversation many times and the instructor and the participant had full-fledged conversations that pertained to pets, travel, upbringing, and personal experiences. These conversations took up the majority of the sessions and there were barely any moments of silence between the instructor and participant.

Participant 47 demonstrated drastic improvement over the 3 sessions. Their eagerness to properly execute the task, as illustrated by their dialogue, may have contributed to this pattern.

Participant 38

Sociality Index Number: 2

Prompted by the instructor, the participant conveys that they are a junior at Emory majoring in human health. On day 1, the participant is very quiet. They do not socialize with their co-participant or the instructor unless the instructor explicitly addresses them. They only initiated conversation at one point, which was the result of the instructor asking them a question that they briefly elaborated on. They heavily focused on the task at hand and their knapping was characterized by large periods of silence and pauses as they frequently appeared to be deliberating where they could next hit their core. On days 3 and 5, the participant slightly opened up and became a little more comfortable in contributing to the conversation, particularly when the topic pertained to academics. However, these contributions were only occasional remarks and were not full-fledged by any means. The participant continued to mainly talk only upon being explicitly addressed apart from the rare comment or question. The general lack of communication that characterizes this participants' session may be a result of them only engaging in group knapping sessions with the instructor and a co-participant, which may have made them uneasy to talk more openly.

Participant 33

Sociality Index Number: 1

The participant is quiet and reserved, rarely engaging in conversation with the instructor or their co-participants during their knapping sessions. For the most part, they only speak when the instructor initiates conversation with them regarding the task, but avoid most of the attempts made to socialize. While the participant does initiate conversation a few times on the last day, these attempts are more of passing comments that did not add much to the current discussion. The participant does not demonstrate much motivation for the task.

Participant 48

Sociality Index Number: 2

Participant 48 was a sophomore at the time of their knapping sessions. They were majoring in Anthropology and Human Biology at Emory and mentioned that they were taking the Biological Anthropology course at the time. The participant is mostly reserved during their individual and

group knapping sessions on day 1 and 3 respectively. They typically only spoke when the instructor initiated a conversation with them, and the conversation usually had to do with the task at hand or experimental protocol. While their co-participant struck a conversation with them, the participant did not reciprocate. On the final day, the participant was a bit more open with the instructor. They responded to the instructor's attempts to socialize, but also initiated conversation a few times. For instance, the participant asked the instructor about their involvement with knapping, and how they developed their knapping experience. Overall, however, the participant kept to themselves and was focused on the task.

The participant demonstrated improvement across the 3 days. Their motivation for the task may have stemmed from them majoring in Anthropology.

Extra participant:

Participant 25

Sociality Index Number: 5

Participant 25 is very cheerful, social, and talkative. They expressed an interest in being an actress or waitress after graduating from college. They immediately felt at ease with the instructor and developed an instant connection with them. As a result, they were quick to share information on their personal life, goals, and hobbies with the instructor, often unsolicited, and even asked the instructor for advice on some of these elements. They also demonstrated an active interest in the instructor's life, asking them questions about their academic goals and personal relationships. In their group knapping session with Participant 26 and the instructor, participant 25 arguably contributed the most to the socializing that took place. They also actively interacted with Participant 26 as well, socializing with them and commenting on the task with them.

Participant 25's performance improved between day 1 and 3, but dipped between day 3 and 5. This may be reflective of the numerous conversations that they engaged in on day 5, which may have detracted from their focus.

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