## CONTRIBUTORS

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# VARIATION IN CULTURAL CONSENSUS BETWEEN EXPERT AND NOVICE BRAZILIAN JIU JITSU ATHLETES

## KARL BENNETT AND WILLIAM W. DRESSLER

## ABSTRACT

The practice of martial arts for leisure and exercise is growing rapidly in the United States. In this study, we utilize mixed methods and cultural consensus analysis to examine a cultural model of strategy among Brazilian jiu jitsu athletes in a gym in Atlanta, Georgia, and to explore how that cultural knowledge varies within consensus. This study builds upon previous research in martial arts studies by employing cultural domain analysis and ethnographic research to quantify and link culture to embodied knowledge through a cultural model of strategy. Results show that strategy in Brazilian jiu jitsu revolves around the hierarchy of positional dominance. Low level belt-ranked novice athletes utilize shared understandings of positional dominance to guide their personal strategic selection of techniques, which they habitually practice to the point of embodied reflexivity. High belt-ranked expert athletes eventually reach a level of expertise at which relying exclusively on the cultural model of strategy impedes their performance in competition. These expert athletes develop a personal model of strategic fluidity within the context of the cultural model of strategy which focuses on adaptation to specific opponents and circumstances.

**MARTIAL ARTS STUDIES**

Variation in Cultural Consensus Between Expert and Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

The study of combat sports is one focus of the mulidisciplinary field of martial arts studies. Bowman [2017] notes the value of diversity in theory and method in the study of martial arts. Our contribution to martial arts studies is to bring a theoretical orientation from cognitive anthropology to build upon insights by previous researchers within the field, specifically to explore the degree to which fundamental models of strategy are shared among martial artists. To examine this aim, we employ mixed methods from cognitive anthropology, specifically cultural consensus analysis and the analysis of residual agreement.

This research focuses on one training center for Brazilian jiu jitsu (BJJ). In BJJ, the primary objective is to win matches, and shared knowledge regarding how to win comprises a cultural model of strategy in BJJ. Athletes utilize this cultural model of strategy to select techniques to practice to the point of reflexive embodied knowledge. In this way, the cultural model of strategy mediates cultural and embodied knowledge. At the same time, there is likely to be diversity among BJJ athletes in the knowledge and application of a shared cultural model. Our theoretical and methodological orientation enables us to examine this with a degree of specificity.

## BRAZILIAN JIU JITSU

BJJ is a combat sport and martial art defined by its focus on ground-based grappling techniques with the goal of opponent submission via joint lock or strangle hold. Competitions in Brazilian jiu jitsu are held internationally, and the popularity of BJJ is rapidly expanding. The history of BJJ lies in Japan with its roots in Japanese *jujutsu* and judo.

Japanese jujutsu refers to the unarmed martial arts techniques employed by the samurai in feudal age Japan, which included many grappling maneuvers [Kano 1986]. After the era of the samurai, jujutsu techniques were used as the basis for the martial art and combat sport of judo. Judo rapidly spread in popularity both in its birthplace of Japan and abroad. By the early 1900s, judo had spread to Brazil where it was modified by the Gracie family, focusing on leverage and groundwork as opposed to the high-impact throws characteristic of judo [Green and Svinth 2003]. The resulting system was developed over the first half of the 20th century and referred to as Gracie Jiu-Jitsu. Members of the Gracie family used their system of fighting with much success in the no-holds-barred '*vale tudo*' ('anything goes') fights in Brazil. This success in their home country was superseded when Royce Gracie, a young member of the Gracie family, entered and won the first Ultimate Fighting Championship in 1993 as the smallest competitor. Gracie's success in the UFC led to the rapid and widespread proliferation of what became known as Brazilian jiu jitsu across the world, and especially in the United States [Green and Svinth 2003].

## MARTIAL ARTS STUDIES

The sociologist Loïc Wacquant's [2004] *Body and Soul* is widely acknowledged as a foundational text paving the way for modern-day martial arts studies [Garcia and Spencer 2013b]. In *Body and Soul*, Wacquant explores the 'pugilistic habitus' of members of a boxing gym in urban Chicago, in part by participating in boxing practice and matches himself. Among other things, this text serves as the proof of concept for Wacquant's proposed theory of 'carnal sociology' operationalized by 'observer participation' [Wacquant 2004].

Drawing heavily from the work of his academic advisor Pierre Bourdieu, Wacquant [2004] argues that embodied boxing knowledge, or pugilistic habitus, is transferred through the physical enactment of boxing via gestures and mimetics. He proposes his theory of carnal sociology as a means to understand the pugilistic habitus of boxers. While various forms of embodied participation have been utilized in previous research, carnal sociology posits that a full understanding of a culture can only occur when the researcher experiences the same bodily sensations as those being studied – by, in essence, deploying the body as a tool of inquiry [Wacquant 2004]. Wacquant dubs the method of deploying the researcher's body as a tool 'observer participation'. Wacquant's work has contributed substantially to the development of the modern-day field of martial arts studies.

Drawing on Wacquant's theory and methods, martial arts studies aims to understand the embodied knowledge of 'martial habitus' through ethnographic methods supplemented by observer participation rooted in carnal sociological theory [Garcia and Spencer 2013b]. Research within martial arts studies has emphasized how the practitioners of combat sports develop embodied knowledge [Hogeveen 2013; Nulty 2017]. Less emphasis has been placed on cognitive, representational forms of knowledge in the process of developing this martial habitus. Our aim in this paper is to help fill this gap by focusing on shared models of strategy among BJJ athletes. We will argue that learning these conventional models of strategy serves as an intervening step in the development of a martial habitus and ultimately the refining of personal strategic model in approaching a match.

This approach also responds to other concerns in this literature. Some researchers have noted the importance of accounting for variation within this embodied knowledge [Brown and Jennings 2013]. Other prominent scholars in the field have argued for the application of mixed methods for tackling larger questions regarding the relationship between culture and embodied knowledge [Bowman 2017; Garcia and Spencer 2013a]. An approach employing cognitive culture theory and cultural domain analysis can provide insight into both the sharing and distribution of cultural models of strategy in BJJ, shedding more light on how knowledge comes to be embodied.

**MARTIAL ARTS STUDIES**

Variation in Cultural Consensus Between Expert and Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

## COGNITIVE THEORY AND METHOD

In cognitive anthropological theory, culture is defined as that which individuals must know to function effectively in a given social environment [Goodenough 1994]. Cultural models are the implicit shared frameworks that enable individuals to more-or-less accurately interpret the behavior of others and that guide individual social practice [Gatewood 2012; Sewall 1992].

This shared or cultural knowledge is encoded in the form of cultural models [D'Andrade 1995]. Cultural models are skeletal, stripped-down cognitive representations of cultural domains that include the elements of the domain along with the semantic, functional, and causal relationships among those elements. Cultural models include one or more prototypes or typical instantiations of event sequences regarding that domain. So, for example, a cultural model of strategy in a martial arts contest would include the participants' understanding of grappling techniques and how they are best deployed in a variety of conditions in order to achieve victory in the contest.

While cultural models are shared (which, of course, is what makes them 'cultural'), there can be substantial variation as well. Cultural models may be strongly or weakly shared. Within the context of overall sharing, there may be contested features of cultural models. And, there may be little overall sharing of a model, with sharing concentrated within specific social groups. All of these alternatives fit comfortably within a theory of cultural models [Dressler 2018; Gatewood 2012].

The utility of a theory of cultural models was enhanced by the development of cultural consensus analysis [Romney, Weller, and Batchelder 1986]. Cultural consensus analysis is a formal statistical model for determining the degree of sharing of knowledge in a domain within a specific social group [Borgatti and Halgin 2011]. An individual's understanding of a particular cultural domain consists of both cultural knowledge, shared with others, and idiosyncratic knowledge derived from personal biography. Consensus analysis determines cultural knowledge by examining what knowledge is shared among individuals and to what degree it is shared. Respondents are presented with a standardized set of questions sampling knowledge in a cultural domain. These may be in the form of true-false, rank-order, or rating scale items. Working from a correlation matrix among respondents, the initial step in cultural consensus analysis is to determine if there is or is not sharing of knowledge sufficient to infer that individuals are drawing on the same pool of knowledge in their responses. Using factor analytic methods (although cultural consensus analysis is not a factor analysis per se), the first two eigenvalues are extracted from the correlation matrix. If the first eigenvalue is several times larger than the second, there is strong evidence of consensus.

Conventionally, a ratio of the first-to-second eigenvalue greater than 3.0 is taken as evidence of cultural consensus [Weller 2007].

Next, cultural consensus analysis returns a set of coefficients assessing the degree to which each individual agrees with the overall consensus. This is referred to as their 'cultural competence'. It varies between a -1.0 and +1.0 and can be interpreted as the correlation of their individual responses with the consensus. In a strongly shared cultural consensus model, there will be no negative cultural competence coefficients and the average of cultural competence coefficients will be high (at least > .50). Finally, cultural consensus analysis can be used to estimate a 'cultural answer key', which is an average of individual responses to the questions, weighted by each respondent's cultural competence, thus giving higher weight to respondents with whom more others agree. This can be interpreted as a 'cultural best estimate' of how a reasonably knowledgeable member of that social group would respond to the questions.

Even in a situation of higher cultural consensus, however, there may be additional subgroup patterns of residual agreement. Residual agreement refers to 'systematic deviations from consensus' [Boster 1986] and is measured through the second factor loadings gleaned from consensus analysis [Dressler, Balieiro, and dos Santos 2015]. Residual agreement analysis itself can take several forms, ranging from quite distinct subgroup models in a domain where there is weak cultural consensus, to subtly nuanced perspectives within a strongly shared cultural model [Boster and Johnson 1989].

Strategy, in the conventional sense, is a plan of action used to achieve a goal [Swidler 1986]. Cultural consensus analysis can be used to examine the degree to which individuals agree on what actions to take in order to achieve such goals. In Brazilian jiu jitsu, the *goal* is to win matches via the application of a submission hold on the opponent, and *strategy* is the selection of techniques to learn and use to win matches. Thus, a cultural model of strategy in BJJ is the shared knowledge of *what* techniques to use in certain situations in order to win a match. This research conceptualizes the cultural model of strategy as the mediator between culture and embodied knowledge which it explores through a joint cognitive anthropological and carnal sociological lens operationalized by consensus analysis, observer participation, interviews, and ethnography.

A model of strategy guides the acquisition and application of techniques to be used in a BJJ match which become embodied. BJJ practitioners select techniques to learn and use to the point of reflexivity by considering what techniques will allow them to win. In BJJ, techniques are cultural knowledge of how to manipulate an individual's body which are the result of hundreds of years of globalized knowledge exchange.

**MARTIAL
ARTS STUDIES**

Variation in Cultural Consensus Between Expert and
Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

Once an individual has selected a technique that will help him or her win based upon shared ideas of how to win, they begin training the technique and implementing the technique in matches. The technique becomes embodied knowledge after the individual has trained and implemented the technique over an extended period of time. Thus, a cultural model of strategy links cultural knowledge to embodied knowledge.

Knowledge of strategy is possessed by individuals and groups. Individuals develop strategies based what has worked for them and what has worked for others. When these individuals effectively apply their strategy to win matches, it influences the strategy of others [Downey 2007]. A cultural model of strategy allows for the application of cognitive methods to determine the contents of the cultural model of strategy and how knowledge of the model is distributed among martial arts practitioners. The cultural model of strategy in BJJ is broad and multifaceted, but this research focuses specifically on the central feature of the model which is the positional dominance hierarchy. Applying the theory and methods of cognitive anthropology, we will examine the degree to which a cultural model of strategy employing positional dominance is shared among BJJ practitioners; what the shared hierarchy of positional dominance is; and, how that cultural model of strategy varies among BJJ practitioners with differing levels of training and experience.

## SETTING: ALLIANCE HEADQUARTERS ATLANTA

Alliance Headquarters lies in Northeast Atlanta, Georgia. Alliance HQ is significant within the jiu jitsu community because it is the headquarters location of the Alliance Jiu Jitsu affiliation, one of the highest ranked affiliations in top level international competition with hundreds of locations in dozens of countries. To better understand cultural models of strategy at Alliance HQ, the first author employed Wacquant's carnal sociological method of observer participation and trained with the athletes at Alliance during the entirety of data collection.

At Alliance HQ, practice sessions follow a basic structure of warm up drills, technique practice, limited scope drills, and a form of open sparring, known as 'rolling'. Rolling closely replicates the conditions of a Brazilian jiu jitsu competition match and begins with students pairing off and performing the 'slap and tap' handshake to signal the beginning of the match. Once a rolling session begins, athletes vie for dominant positions and ultimately submission holds. Once an athlete has successfully applied a submission hold in the form of a choke or joint lock, his opponent 'taps out' to signal defeat. Tapping out consists of either physically tapping an opponent's body with a hand, or verbalizing 'tap!' loud enough for the opponent to hear. The strategic element of the sport is evident when watching athletes, especially at high levels,

methodically pit techniques and counters against one another in this struggle for dominance.

Athletes fall into one of five belt ranks: white, blue, purple, brown, or black, based on their level of experience. Although there are only five belt ranks, it takes years for athletes to progress from one belt rank to the next. Acquiring a blue belt often takes two years, and acquiring a black belt often takes a decade or longer. The following methods were used to explore shared understandings of strategy among these jiu jitsu athletes.

## METHODS

### Observer Participation

In order to better understand the embodied and shared knowledge of strategy in BJJ at Alliance HQ, the first author, who had several years of experience in grappling sports at the time of the research, employed Wacquant's method of carnal sociology and observer participation by training with athletes at Alliance throughout the entire period of data collection. The insights gleaned from this method, while not recorded in a traditional format, enabled the first author to have a better understanding of the basic training of a BJJ athlete and heavily informed the remainder of the data collection and analysis. This observer participation provided depth and nuance to the descriptive portion of the research. Participation in the everyday activity of the gym also served build rapport and trust with the participants in the study.

### Phase I Methods

All data collection took place during the months of May and June 2017 at Alliance HQ in Atlanta, GA and consisted of Phase I preliminary open-ended interviews, Phase II structured interviews including a pile sort/rank order exercise, and Phase III semistructured follow-up interviews. For Phase I interviews, non-random purposive sampling was used to select five black belts based on availability as well as official and unofficial recognition of authority within the gym. The five selected gym members were asked general and personal questions regarding history, philosophy, and strategy in BJJ. Interviews were recorded, transcribed, and analyzed using NVivo software. The results of this analysis were used to inform the interpretation of the Phase II consensus analysis results.

### Phase II Methods

Phase II utilized stratified convenience sampling to select 10 participants from each belt-rank (white, blue, purple, brown, and black) at Alliance HQ to participate in structured interviews, resulting in a total of 50

**MARTIAL ARTS STUDIES**

Variation in Cultural Consensus Between Expert and Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

structured interviews. The interview schedule for Phase II structured interviews consisted of a demographic information section (sex, belt-rank, height, weight, education, employment status, and competition frequency) and a rank order/pile sort section. For the rank order/pile sort section of the interview participants were presented with 14 laminated note cards with a position commonly employed in BJJ written on each card. Participants were asked to group together cards and then order those groups in terms of positional dominance. Participants were informed that the position of cards within the same group was not considered, only the position of each group relative to other groups and the contents of those groups. Additionally, participants were informed that they could make as many or few groups as they felt appropriate.

Data collected from the rank order/pile sort exercise was first coded as pile sort data. Nonmetric multi-dimensional scaling coordinates from the pile sort data were obtained using the program ANTHROPAC and a nonmetric multi-dimensional scaling plot was obtained using the Statistical Package for the Social Sciences (SPSS). Each participant's response was coded as pile sort data with the number of groups created by participants and the contents of those groups being considered but not the order in which they placed the groups. This pile sort data was input into ANTHROPAC to create an aggregate proximity matrix which displays the proportion of times two positions appeared in the same pile. The values from the aggregate proximity matrix were then used to obtain coordinates for a nonmetric multi-dimensional scaling plot. These coordinates were then input into SPSS to create the nonmetric multi-dimensional scaling plot. A nonmetric multi-dimensional scaling plot places elements onto a two dimensional space based upon their level of association with each other. The nonmetric multi-dimensional scaling plot used the values from the aggregate proximity matrix to display the 14 BJJ positions on a plot based on the 50 participants' shared perceived association between each position.

In addition to being coded as pile sort data, data collected from the rank order/pile sort exercise was also coded as rank order data, and consensus analysis was performed in ANTHROPAC. BJJ positions belonging to groups of BJJ positions considered to be more dominant were given higher rank values than those assigned into groups of BJJ positions considered to be less dominant. Additionally, participants with more groups of BJJ positions had higher values associated with the group they indicated as most dominant. For example, a participant who created nine groups of BJJ positions had a value of nine given to all the BJJ positions in the group of BJJ positions they categorized as most dominant, whereas a participant who created five groups had a value of five given to all the BJJ positions in the group of BJJ positions they categorized as most dominant. Regardless of how many groups of BJJ positions a participant created, all positions they grouped in the lowest group were given a value of one. Consensus analysis was conducted in

ANTHROPAC which yielded an eigenvalue ratio indicating the level of consensus among the group as well as competence values for each individual. The competence values for each individual participant were input into SPSS in order to perform hypothesis testing. We recognize that combining ranking and pile sorts in this way is somewhat unusual, but it conforms to the thinking of our respondents. A standard – i.e, unordered – pile sort was attempted, but no respondent was willing to categorize positions without respect to their potential dominance in a match setting. Therefore, the coding and analysis of the data accurately reflects the respondents' thinking.

To test the hypothesis that competence in the cultural model of strategy is higher in individuals with higher belt-rank, a one-way analysis of variance (ANOVA) was conducted. Belt-rank was set as the independent variable and competence was set as the dependent variable. The alpha level was set at .05. A nonparametric ANOVA was also conducted to ensure accuracy of the one way ANOVA results due to non-normality in the data.

Furthermore, residual agreement analysis was conducted on the rank order data. The technique for residual agreement analysis developed by Dressler, Balieiro and Santos [2015] was used. Participants were sorted into two groups based on whether their second loading factor score was positive or negative. Consensus analysis was conducted on both groups independently, and the cultural answer key of each group was input into SPSS alongside the cultural answer key for the entire sample. The values of the cultural answer key for the entire sample were subtracted from the cultural answer key of both the positive and negative second factor loading groups, and the resulting variables were used to create a plot displaying the elements of the cultural model of strategy by which the two groups diverged in knowledge. Finally, ANOVA was used to test the relationship between average residual agreement and belt rank.

### Phase III Methods

Semistructured follow up interviews were conducted in Phase III to determine how individual strategy at different belt-ranks relates to the cultural model of strategy. Non-random purposive sampling was used to select one white belt, one blue belt, one purple belt, one brown belt, and three black belt respondents based on their availability. Participants were asked questions regarding their personal history in the sport, defining aspects of their personal strategy, development of their personal strategy, and for elements of their strategy which defy generally understood strategic conventions. Interviews were recorded, transcribed, and analyzed using NVivo software. The results of this analysis were used to aid in the interpretation of the Phase II consensus analysis results.

**MARTIAL
ARTS STUDIES**

Variation in Cultural Consensus Between Expert and
Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

## RESULTS

**Qualitative Results**

Phase I interviews indicated that a salient element of strategy among members of Alliance HQ was the concept of 'position over submission', which indicates a preference to maintain dominant positions rather than attempt submissions from non-dominant positions. Furthermore, 14 commonly used positions were elicited during this phase. Finally, qualitative analysis indicated three common categories into which these positions are grouped. Risky positions are identified as such because both athletes are considered to have high degrees of mobility but low control over their opponent, which indicates the possibility for a rapid change in positional dominance. Positions in this category include Both Standing, Top Sprawl, and Kesa Gatame (a position similar to a finished 'headlock' position in American styles of wrestling).

Guard Positions include all positions related to the guard but can be further categorized into top guard and bottom guard positions. Bottom guard positions are those in which the athlete is on bottom with legs wrapped around the body or legs of their opponent and include the Closed Guard, Half Guard, and Open Guard. The goal of an athlete in a bottom guard position is to 'sweep' the opponent – meaning to make a transition to a top side finishing position – in order to achieve a more dominant position or to attempt a submission from the guard. Top guard positions are those in which the athlete is entangled by the legs of their opponent and include the Standing in Guard, Kneeling in Guard, and Top Half Guard. The goal of an athlete in a top guard position is to 'pass' the guard of their opponent in order to achieve a finishing position.

Finishing positions were considered the most dominant group of positions. The goal of an athlete in a finishing position is to maintain that position and attempt high percentage submissions resulting in winning a match. Positions included in this group are Mount, Back Mount, Side Control, North South, and Knee on Belly. Generally, these positions were all considered to be of equal dominance, but some participants noted that 'Mount' and 'Back Mount' were more dominant than the other three positions.

Phase III interviews elicited three primary themes regarding the development of personal strategy in the context of shared ideas of strategy: Fluidity, Personal History and Physicality, and Weaknesses into Strengths. Fluidity refers to the degree to which athletes adapt their personal strategies to conform to the strengths and weaknesses of their opponents. Interestingly, the theme of fluidity was far more evident in the personal strategies of higher belt ranked athletes than lower belt ranked athletes. Lower belt ranked athletes generally had a single fixed

strategy which they applied indiscriminately against every opponent. Conversely, high belt ranked athletes did not conceive of personal strategy outside the context of the details of a particular match such as what opponent they are facing and their opponent's strategy. The concept of fluidity is best exemplified by the following quotation from a participant.

I think a lot of it has to do with just adapting, being able to adapt during the fight and apply […] it's like playing video games – you've got the mage, the ranger beats the mage, mage beats the knight, the knight beats the ranger. So you need to be able to look into this diagram and understand how these positions can be applied against other positions to beat them. It's the same thing in jiu jitsu. For example if the guy's on his knees, I can't play de la riva, he just countered my de la riva guard, so now I have to play either spider or maybe butterfly or something, so then he wants to stand up and then I gotta lay back down and now I can play de la riva.

The second theme elicited in this phase was Personal History and Physicality. Participants commonly cited personality attributes, participation in other athletic endeavors, and physical attributes as the origin of peculiarities and preferences in their personal strategy. Notably, the tendency to point to these factors as contributing to personal strategy – or even to *having* a fixed personal strategy – generally decreased with experience level as noted in the Fluidity theme.

The third theme elicited in this phase was Weaknesses into Strengths. Related to the theme of personal history and physicality, participants noted that some aspects of their personal strategy they identified as particularly effective were the result of compensation for weaknesses in other aspects of their game. This included physical weaknesses and technical weaknesses. Again though, more advanced athletes were generally less likely to point to their weaknesses as playing a role in their strategy – presumably because they were less likely to point to having a defined personal strategy in general as indicated in the fluidity theme.

**Phase II Descriptive Statistics**

Fifty members of Alliance HQ, 10 from each belt-rank (white, blue, purple, brown, and black) participated in Phase II data collection. Background data on the sample are presented in Table 1 above. All participants were male with an average age of 36.6. Participants with white belts tended to be somewhat younger than other belt ranks, although not significantly, and levels of education and occupational statuses tended to be comparable.

| | Total Sample (n=50) | White Belt (n=10) | Blue Belt (n=10) | Purple Belt (n=10) | Brown Belt (n=10) | Black Belt (n=10) |
|---|---|---|---|---|---|---|
| **Age in Years** | 36.56 (±9.04) | 33.80 (±12.57) | 37.90 (±6.40) | 37.30 (±11.55) | 34.60 (±5.27) | 39.20 (±7.89) |
| **Highest Level of Education** | | | | | | |
| High School (%) | 4 | 0 | 0 | 0 | 10 | 10 |
| Some College (%) | 16 | 30 | 10 | 10 | 0 | 30 |
| 4 Year Degree (%) | 52 | 60 | 50 | 60 | 50 | 40 |
| Graduate Degree (%) | 28 | 10 | 40 | 30 | 40 | 20 |
| **Occupation** | | | | | | |
| Unskilled/unemployed (%) | 10 | 10 | 0 | 10 | 0 | 30 |
| Technical/mamgerial (%) | 56 | 60 | 70 | 60 | 70 | 20 |
| Professional/business owner (%) | 34 | 30 | 30 | 30 | 30 | 50 |

*Table 1:*
*Descriptive statistics for*
*study participants*

### Multidimensional Scaling

The results of the sorting/ranking task, treating the positions solely in terms of how they were grouped, is presented in Figure 1 overleaf. The multidimensional scaling plot displays a clustering of the positions identified as finishing positions in Phase I on the left side of the plot, including 'Mount', 'Back Mount', 'Side Control', 'North South', and 'Knee on Belly'. Additionally, another cluster further to the right contains all of the positions identified as guard positions. Finally, not fitting neatly into either of these clusters, the risky positions of 'Both Standing', 'Top Sprawl', and 'Kesa Gatame' are positioned outside of the other clusters. Interestingly, the finishing positions in the multi-dimensional scaling plot are closely clustered together, whereas the guard positions are loosely clustered. This demonstrates high levels of association regarding finishing positions and low levels of association regarding guard positions. Additionally, the three risky positions are interspersed throughout the plot and not clustered together at all. The difference in the cluster density between finishing and guard positions as well as the wide dispersion of risky positions is consistent with the qualitative evidence from Phase I and III interviews. Participants in Phase I noted that guard positions were further grouped into bottom guard and top guard positions, but that both bottom and top guard were considered to be of equal dominance. The differentiation between top guard and bottom guard positions in relation to personal strategy was further explicated in Phase III. The relatively larger cluster size of guard positions in the multidimensional scaling plot is a result of the acknowledgement of individual strategic variation within the guard position category. Simply put, practitioners recognize that while personal preference for top guard 'passing' or bottom guard 'sweeping' strategies are distinct from each other, both are of equal dominance.

The three positions identified as risky are interspersed throughout the plot and not clustered in a coherent fashion. These positions are distributed in this manner on the plot because of the identified variation in dominance between these positions. The highly dominant finishing positions are clustered on the left of the plot, and the less dominant guard positions are clustered towards the right of the plot which indicates that positions become more dominant when going right to left. This explains the distribution of the risky positions because 'Both Standing', which was considered the least dominant of the three, is on the far right of the plot. Furthermore, 'Top Sprawl' was identified as more dominant and is further left of the 'Both Standing' position. Finally, 'Kesa Gatame' was identified as the most dominant risky position and is positioned furthest left of all three positions identified as risky. The labelling of these positions as risky explains why they are not clustered with either the categories of finishing or guard positions, and the identification of a dominance hierarchy within risky positions explains their distribution on the plot.

### Cultural Consensus

When the ranking of the positions in terms of positional dominance was examined with cultural consensus analysis, a consensus was found. The ratio of the first-to-second eigenvalue, indicative of overall agreement, was 8.138, with a mean cultural competence of .79 (±.15). Participants widely agreed that finishing positions (those to the left in Figure 1) were more dominant than guard positions, and that risky positions involved little control of an opponent.
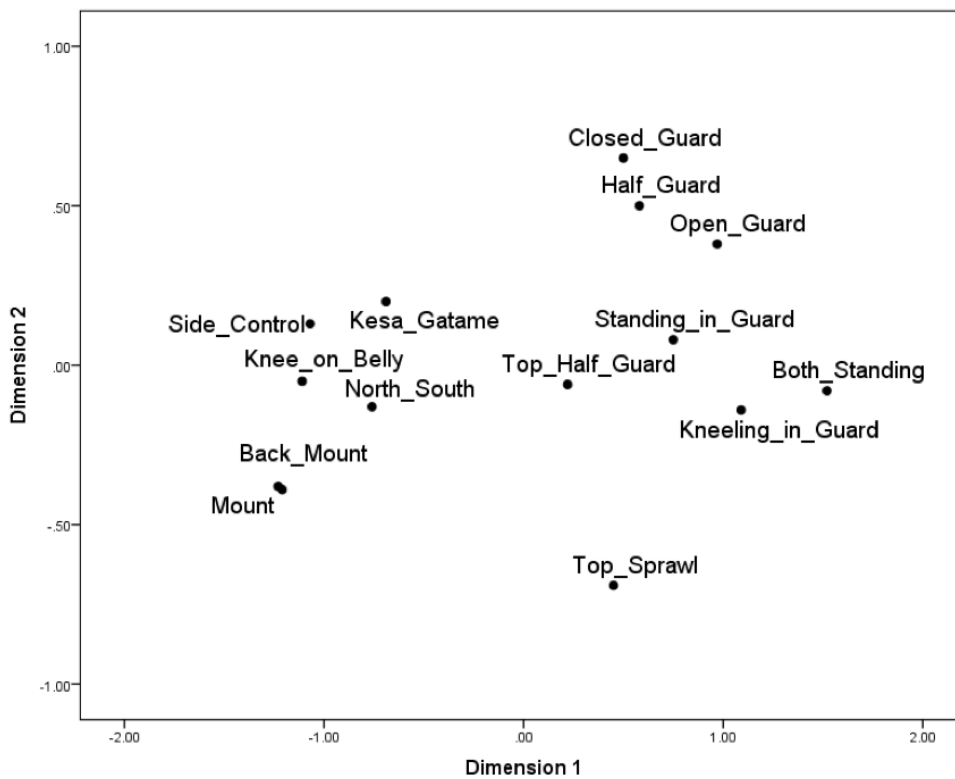
**MARTIAL ARTS STUDIES**

Variation in Cultural Consensus Between Expert and
Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

*Figure 1:*
*Multidimensional scaling plot of pile sort of positions*
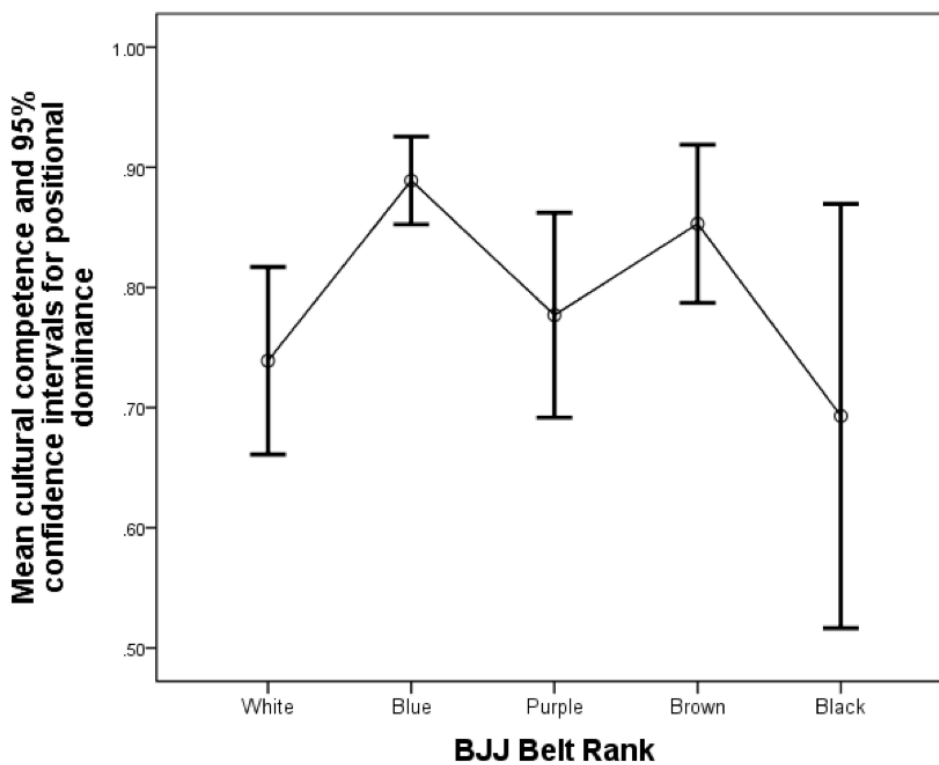


*Figure 2:*
*Mean cultural competence by belt rank*

**MARTIAL
ARTS STUDIES**

Variation in Cultural Consensus Between Expert and
Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

A one-way ANOVA was carried out to determine if there were differences in cultural competence by belt rank. The resulting F-ratio was significant (F = 3.31; df = 4, 45; p < .02), indicating differences among belt-ranks in the degree of agreement with the overall cultural consensus regarding positional dominance. These differences are shown in Figure 2 opposite. Post-hoc comparisons indicated that blue belts tended to have the highest cultural competence, while black belts tended to have the lowest cultural competence. Another interesting feature of Figure 2 is the higher overall variability in cultural competence among black belts. While these differences stand out, it should be emphasized that no group lacks an understanding of the cultural consensus model of strategy (i.e., mean cultural competence for each belt rank is > .69). The results do show, however, that cultural consensus analysis is sensitive enough to detect subtle differences among the belt ranks.

**Residual Agreement**

Finally, residual agreement was explored. As noted above, residual agreement exists when there is sharing beyond the original consensus. The study of residual agreement requires that the original consensus be removed from ratings; hence, Dressler et al. [2015] found that ratings from subgroups identified by the second factor loadings could be analyzed in terms of the deviations of items within those subgroups from the original cultural consensus. When these deviations are plotted,

it can pinpoint where in the domain of the knowledge the groups diverge.

The plotted deviations of the items are shown in Figure 3. The two groups were formed by dividing the sample based on the sign of the second factor loading. Furthermore, analysis of variance showed that the deviations plotted along the x-axis derive primarily from black belt respondents, while the deviations along the y-axis derive primarily from white belt respondents. There is a tendency for white belts to rate as somewhat more dominant than the consensus precisely those positions that the black belts rate as less dominant. Conversely, the black belts rate as more dominant precisely the positions that the white belts rate as less dominant. (The correlation between the two sets of ratings is r = -.99). In general, the black belts rate risker positions as somewhat more important than the overall group consensus, while the white belts tend to rate more basic positions as more important than the overall group consensus.

## DISCUSSION AND CONCLUSION

The aim of this study was to build upon previous research on martial arts by employing a theoretical approach derived from cognitive anthropology and applying a mixed-methods research design. Employing cultural consensus analysis, we found that there is strong agreement on the dominance of the primary positions employed in BJJ
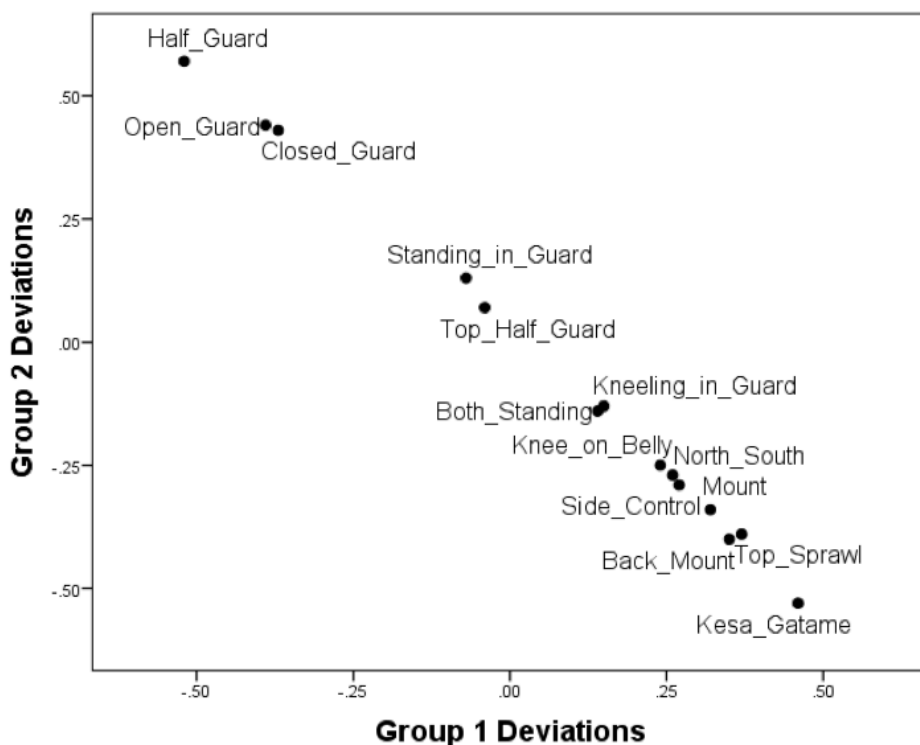


*Figure 3:
Residual agreement analysis*

MARTIAL
ARTS STUDIES

Variation in Cultural Consensus Between Expert and
Novice Brazilian Jiu Jitsu Athletes
George Karl Bennett and William W. Dressler

grappling. Generally, members of Alliance HQ categorize positions as either guard, finishing, or risky positions. Guard positions are considered less dominant than finishing positions, and the goal of an athlete in a guard position is to transition to a finishing position. Finishing positions are the dominant category and an athlete's goals in finishing positions are to attempt submission holds to win the match. Risky positions can vary in dominance but offer an athlete less control over their opponent's body.

The major aim of the study was to determine if BJJ athletes shared a basic model of the deployment of these positions. Analyses using cultural consensus analysis indicated a relatively strongly shared model with, at the same time, systematic variation in the distribution of agreement. The mean cultural competence for the model overall, .79 (± .15), indicates that, for about 11 out of the 14 items, BJJ respondents order positions in the same way along a continuum of dominance, leaving about three of the items to be placed idiosyncratically in their rankings. At the same time, however, cultural consensus analysis is sufficiently sensitive to detect systematic variation among the belt ranks, with the intermediate belt ranks having higher cultural competence than the lowest and highest ranks. This is consistent with a process in which participants in the sport slowly develop competence in the model of fighting as they train more and that knowledge becomes embodied, and then after a time they come to integrate their own personal strategy along with the culturally encoded model of strategy.

This interpretation of the process would suggest a perfect inverted parabola or bicorn curve describing the association of belt rank and cultural competence; however, purple belts are not consistent with this pattern of association. During observer participation, the first author noted a tendency for some of the purple belts in training to have earned their ranking at other centers, having trained under different systems. Therefore, while they are experienced in jiu jitsu, they are still relatively new to the system of BJJ. This could account for this anomalous finding.

The major variation detected in the sharing of the cultural model of positional dominance involves the relatively lower agreement with the overall model exhibited by black belts; the large range of variation in cultural competence among black belts; and, the high residual agreement among black belts. This variation is consistent with open-ended interviews conducted with black belts, and specifically the notion of fluidity introduced earlier. Rather than going for positions that are generally regarded as dominant, black belts alter their strategies depending on the action of their opponents. They know, both in a strictly cognitive sense and in an embodied sense, the strongest positions. They know, at the same time, that riskier positions can be employed against opponents who present with specific weakness or tendencies, and they have the skill to deploy those riskier positions. The analysis of residual agreement confirms this, showing that black belts do indeed rate those riskier positions as more useful than the overall

group of athletes rates them in the total group consensus model. As the common saying goes: 'You have to know the rules to break them'.

With respect to the model of positional dominance itself, among guard positions, members recognize both top guard and bottom guard positions. Both top and bottom guard are considered to be of equal dominance, and individual preference for top or bottom guard positions is dictated by the personal history and physicality of athletes. In some instances, weaknesses of some athletes force them to prefer certain positions, and they often become highly proficient in these positions. White belts prefer bottom guard positions relative to the overall sample because their most common opponents, other beginners, are susceptible to attacks from these positions. Black belts display relatively lower levels of agreement regarding the cultural model of strategy because they have developed an idiosyncratic perspective regarding strategy and demonstrate a preference for risky but dominant positions relative to the overall sample. This idiosyncratic perspective of strategy is largely informed by the theme of fluidity and results in low levels of agreement regarding a fixed model of strategy among black belts.

These results are consistent with other studies that have compared novices and experts. For example, in their study of sport fishermen, Boster and Johnson [1989] found that novices and experts strongly shared a model of the classification of fish on the basis primarily of morphology. At the same time, in analyzing residual agreement, they found that expert fishermen diverged somewhat from this basic knowledge by including their more sophisticated understanding of fish behavior and habitat. They argue that the experts do not have a different model, but rather are able to layer on additional knowledge to the base. This offers another way of thinking about fluidity among the black belts; they have command over the basic model, but layer on top of this a more sophisticated understanding of positional dominance based on years of experience and competition.

Garcia and Spencer [2013a] and Bowman [2017] have argued for the elaboration of research design and data collection in the study of martial arts. The research presented here built upon previous studies of martial arts by utilizing a cognitive anthropological framework to examine the role of representational knowledge in the development of an embodied strategy in matches. This study thus contributes both to the field of martial arts studies and to a better understanding of distributed cognition, again demonstrating the theoretical value of a focus on the martial arts [Bowman and Judkins 2017].

**MARTIAL ARTS STUDIES**

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George Karl Bennett and William W. Dressler

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Cardiff University Press
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Martial Arts Studies
Journal design by Hugh Griffiths

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