

A Thought Experiment to Investigate the Origin of Gender-Based Division of Labor

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The Asian Conference on the Social Sciences 2025
Official Conference Proceedings

Abstract

This article presents a thought experiment (Brown & Yiftach, 2023) to investigate the origin of sexual division of labor. The purpose is to grasp the inner logic of the transformation rather than describing the actual historical process. We believe that a clear understanding of the origin of gender-bias will help us to mitigate its harmful effects and establish an unbiased society. Empirical study suggests that sexual division of labor evolved during the Upper Paleolithic era (Kuhn & Steiner, 2006). Anthropological research indicates that sex based division of labor gave modern humans some advantage over the Neandertals (Lovegren, 2006). Scholars have offered various explanations of gender-bias *e.g.* power and private property (Engels, 1877), Biological (Mardock, 1949), Biogrammings (Tiger & Fox, 1971) etc. Scientists, Historians and Philosophers have investigated the gendered power structure (De Beauvoir, 2015; Engels, 1877; Harari, 2015; Lerner, 1986; Walby, 1989) extensively. This study considers a small group of hunter-gatherers. It's struggle for existence can be modelled as a constrained multi-objective optimization problem (Liang et al., 2024) to maximize food security, minimize child and female mortality under the constraints of limited food supply, inter-group competition, uncontrolled pregnancy, disease, injury etc. Three orthogonal systems, namely, i) *gender-neutral*, ii) *male as homemaker-caregiver and female as protector-provider*, and iii) *female as homemaker-caregiver and male as protector-provider* were evolved over successive generations. Outcome analysis indicates that third system ensures best fitness for survival and growth. However, this study addresses only the pre-historical origin of sexual division of labor. Important aspects *e.g.*, cultural diversity, social evolution, gender dynamics etc. are later developments.

Keywords: gender, labor, optimization, fitness, survival

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Introduction

In traditional social systems, women are confined within the domestic spheres in contrast to men who undertake all enterprises in the outside world, beyond the domestic boundary. Apparently, such gender-based division of labor has resulted in a hierarchical power structure where the women are placed at a level lower than the men (De Beauvoir, 2015; Engels, 1877; Harari, 2015; Lerner, 1986; Walby, 1989). This article intends to investigate the origin of such gender-based division of labor. The purpose is to arrive at a plausible explanation of the underlying historical process. It is expected that a clear understanding of such causal relationship will help us to establish an enhanced level of social justice and harmony.

Philosophers, social scientists, social anthropologists and others have considered the issue of gender-based division of labor from various perspectives. Friedrich Engels, in his celebrated work “The Origin of the Family, Private Property and the State” (Engels, 1877) has emphasized the role of private property in “*the world historic defeat of the female sex*”. In (Tiger & Fox, 1971), Lionel Tiger and Robin Fox emphasized the role of biogrammers, i.e., genetically programmed features that distinguish men from woman in terms of aggressiveness, dominance, compassion, love etc. Tiger and Fox argued, men were naturally inclined to take the role of hunter-gatherer and women the homemaker and caregiver. Similar explanation, based on the biological difference between man and woman, was provided by George Peter Mardock (Mardock, 1949). Men are, in general, physically stronger than women. Therefore, they are naturally suited for activities that require muscle power, e.g., hunting, fighting etc. This eventually makes them fit for the role of protector-provider of the family. Women, on the other hand, are physically weak and soft. Women become even more vulnerable during pregnancy. After childbirth, women must breastfeed the baby. Breastfeeding is an activity which inherently supports the feelings of love and compassion. For these reasons, according to Mardock, women naturally fit to the role of home maker and caregiver.

To investigate this issue, this article proposes to consider the social dynamics of a pre-historic hunter-gatherer community over several successive generations. It is argued that the struggle for existence of such a community could be modeled as a constrained multi-objective optimization problem (Liang et al., 2024). Three orthogonal social structures were allowed to evolve through several generations. Eventually, the social structure (and the corresponding division-of-labor) that improves the survival fitness and fosters growth of the community, got stabilized over time. Structures which resulted in sub-optimal survival fitness have either died out or remained isolated systems without further growth.

The Thought Experiment

A thought experiment (Brown & Yiftach, 2023) is an imaginary situation which is logically consistent but not necessarily empirically feasible. The present thought experiment is concerned about a small group of primitive hunter-gatherers. The size of the population is about 50. A larger group may be ruled out because the prehistoric communication technique was not adequately developed to support the cooperation among a larger group of humans (Harari, 2015). The group consists of adult males, females and children. The group exists as a commune. Family structure is yet to develop. Both the male and female are free to mate with anyone of his/her choice. Reproductive activities, i.e., mating, pregnancy, childbirth, feeding the newborn, raising the newborn etc. are biologically decided. Motherhood is biological. There is no system to identify the biological father. However, the community has learnt the

controlled use of fire. Food, especially non-vegetarian food, is cooked. Members of the community either live in caves or makeshift shelters temporarily. They move from place to place depending on the availability of food or other living conditions.

Optimization Goals

The entire community would like to survive and grow just as its individual members. From this point of view, the following optimization goals may be set for our primitive community: i) maximize food security, ii) maximize female fertility (to ensure growth of the community), iii) minimize female mortality (to maintain birth rate. Men, however, as sperm-donors, are easily replaceable and therefore indispensable), iv) minimize miscarriage of unborn baby, v) minimize child mortality (to ensure growth), and so on. All these factors contribute to the maximization of survival fitness of the entire group of humans.

Constraints

In their struggle for existence, the members of this pre-historical community are constrained by several factors *e.g.*, i) scarcity of food, or uncertainty of food supply, ii) competition with other groups, iii) competition with other animals, iv) high child mortality, v) female death during childbirth, vi) death or injury during fight with animals or other groups, vii) miscellaneous risk factors in the wild surroundings, viii) lengthy human childhood and so on. Let us now consider the activities of the individual members as well as the community.

Activities

Members of this prehistoric group of human beings are engaged mostly in biological activities *e.g.* food gathering, cooking, hunting, fighting against aggressors, mating, childcare, and so on. Some of these activities are collaborative. For instance, hunting, or fighting against enemies are more effective when done as a group. Mating is undoubtedly a private affair between two individuals. So too is breastfeeding. Eating is personal, but also social to some extent in the sense that quite often they enjoy a meal together.

Three Orthogonal Structures

Suppose there are three such groups, *viz.* Group *A*, Group *B* and Group *C*. In the beginning each of these three groups follows primitive egalitarianism. But then the three groups underwent a transformation to structures based on three orthogonal systems of division of labor. Group *A* continues primitive gender-equality without any change in social structure. In Group *B* the male acts as the homemaker-caregiver while female is the protector-provider. In Group *C*, however, the female is the homemaker-caregiver and the male becomes the protector-provider. We allow these three groups to evolve over consecutive generations.

Outcome Analysis

The effect of such gender-based divisions of labor on the respective populations should be observable after several generations. *Group-A* should maintain status quo. As the social structure remains the same, it continues its state of primitive gender neutrality. In the absence of any dramatic change in geography or climate, this group neither grows, nor shrinks. It is unlikely to develop any cultural element within its animalistic existence, just like other animals on earth. *Group-B* undergoes changes in several aspects. Mobility and agility of

pregnant females are less than normal. Females with newborn babies are less likely to provide their full efforts to activities like hunting or food gathering. Consequently, *Group-B* suffers reduced food security. Again, since females take the role of protector-provider, they are exposed to higher risks of physical stress and injury than their male counterpart. This leads in increased chance of miscarriage. Therefore, female fertility rate of *Group-B* decreases after several generations. Due to same reason female mortality rate increases. Increased miscarriage and reduced food security leads to a higher rate of infant mortality. The net result of all these factors is that the *Group-B* became less fit to survive. Finally, *Group-C* undergoes the reverse trend of *Group-B*. Here females are able to devote full attention to their children in the relatively peaceful and secured shelter. For them risks of physical injury, miscarriage etc. are reduced. However, males are able to apply their muscle power maximally for the purpose of hunting-gathering for all members of the group, including the females. So *Group-C* could enhance its food security. Similarly, female fertility rate increases. Female mortality rate as well as infant mortality rate decreases. The only adverse effect is higher risk of physical injury and death for the males as they are exposed to the dangers to a greater extent. But male lives are less critical as compared to female lives. Eventually *Group-C* is able to enhance its fitness for survival and growth.

Let us summarize. There is no tangible change in *Group-A* as it continued its primitive equality. Due to decline in food security, reduced female fertility, increased child mortality and increased female mortality *Group-B* becomes less fit to survive. *Group-B* shrinks over successive generations. Exactly the opposite happens to *Group-C*. This group could enhance its food security, improve female fertility rate, reduce child mortality rate, and decrease female mortality. Hence *Group-C* enhances its survival fitness and grows.

Conclusions

A thought experiment that encapsulates the historical process of transformation from primitive gender-neutral egalitarian society to a system of gender-based division of labor has been presented in this article. The experiment considers a small prehistoric group of hunter-gatherers. It is argued that the struggle for existence of such a community can be formulated as a multi-objective, constraint-satisfying, optimization problem where the group would like to maximize food security, maximize female fertility, minimize female mortality, and minimize child mortality. Several challenges faced by the group in attaining these goals have been taken into consideration. If the primary activities of the members of such prehistoric hunter-gatherers include food gathering, hunting, fighting (against aggressors, or other carnivorous animals), elementary cooking, childcare etc. then a division of labor could help the community to perform these activities efficiently. Accordingly, three orthogonal divisions of labor were taken into consideration. Three identical groups, *Group X*, *Group Y* and *Group Z*, simultaneously start their journey by adapting the three types of division of labor. The first option is trivial with no division of labor at all. Therefore, *Group X* maintains status-quo. The second option, followed by *Group Y*, ascribes the female members the role of protector-provider and the male members that of homemaker-caregiver. We show that the survival fitness of *Group Y* drops over successive generations. This community becomes progressively weaker, and eventually the population shrinks. The reverse effect occurs in *Group Z* where the males act as protector-provider and females as homemaking-caregiver, thereby making *Group Z* best fit for survival and growth over successive generations. In short, we may conclude that the present gender-based division of labor has been adopted almost universally by the entire humanity over thousands of years because it helped human societies to survive

and grow. However, relevance of this gender based division of labor in the contemporary world is a debatable issue.

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