Gemini Deep Research

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Reward Systems: Human and LLM

Reasoning

Understanding Reward Systems

I'm starting by looking into what exactly constitutes a reward system from a psychological and behavioral science perspective. This will give me a foundational understanding for exploring how these systems are shaped by our experiences and environments.

Exploring Contextual Influences

Next, I plan to investigate how various aspects of our lives, such as our social circles, the political climate, our surroundings, and our upbringing within our families, contribute to shaping these individual reward systems. I'll be focusing on insights from developmental psychology and sociology to understand these influences.

Analogy to AI Learning

I'm also thinking about how this relates to the way large language models are trained using Reinforcement Learning from Human Feedback (RLHF). I'll be drawing parallels between how reward signals shape human behavior and how they guide the responses of AI models, considering both scenarios with strict guidance and more open-ended creative tasks.

Next Steps in Research

My next steps involve delving into the concept of 'niche environments' to understand how certain reward-action patterns can be successful in specific contexts. I also want to explore the idea of a 'collective consciousness' and how it might interact with and potentially challenge these more localized reward systems when they are applied more broadly.

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Core Concepts of Reward

I've gathered initial information defining reward systems in psychology. These systems in our brains drive us towards behaviors that are essential for survival and well-being by releasing dopamine and creating feelings of pleasure. This process not only makes us feel good but also motivates us to repeat these actions. Rewards can be things like food and social interaction, but also things like money or even drugs.

Reinforcement of Actions

I'm also understanding how these reward systems work to reinforce our behaviors. When we do something and get a positive outcome, that action becomes more likely to happen again in

the future. This is called positive reinforcement, and it's a key way we learn and develop habits. It seems that rewarding good behavior is often more effective than punishing mistakes.

Reward vs. Reinforcement

It's interesting to note the subtle difference between a 'reward' and 'reinforcement'. While we often use these words interchangeably, in behavioral science, a reward can be seen as the thing we receive, whereas reinforcement is the actual process of that reward making us want to repeat the behavior. So, a treat can be a reward, but the feeling of satisfaction it gives and the increased likelihood of us performing the action again is the reinforcement.

Further Exploration

Now that I have a better grasp of the basics, I need to investigate how our social lives, political environments, physical surroundings, and family backgrounds influence how these reward systems develop within us. I also want to explore the connection between these ideas and how large language models learn from human feedback, particularly how different levels of guidance can shape their behavior.

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Context Shapes Our Rewards

I've found that our social interactions, the political situations we're in, our environment, and our family experiences all play a significant role in how our personal reward systems develop. For instance, positive interactions can make rewards more enjoyable, while negative political climates can lower morale. Even our socioeconomic background can affect how sensitive we are to rewards.

AI Learns Like Us

It's fascinating to see how the process of training large language models using feedback from humans mirrors how our own brains learn through reward. Just like we are motivated by positive experiences, these AI models adjust their behavior based on what humans consider good outputs. This can be very directed, ensuring the AI follows specific rules, or more open, allowing for more creative responses, similar to how different environments can shape our learning.

Continuing the Investigation

I still need to explore how reward systems that work well in very specific situations might not be so effective in broader contexts. I also want to understand the idea of a shared 'collective consciousness' and how it might challenge individual reward systems. Additionally, I plan to look at historical examples, like empires, to see if their rise and fall can be linked to these reward dynamics.

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Refining the RLHF Analogy

I'm focusing on making the connection between human reward systems and Reinforcement

Learning from Human Feedback in AI even clearer. I'm thinking about how the reward functions in RLHF, and the different ways humans provide feedback, are similar to the processes that shape our own behavior and motivations. This includes looking at scenarios where the AI's behavior is very closely guided, as well as situations where it has more freedom to generate responses, similar to the varying influences in our lives.

Examples of Limited Success

To make the idea of 'niche environments' more understandable, I'm considering specific real-world examples. These could be situations where certain behaviors are highly rewarded in a small group or community but might not be accepted or successful in a larger society. This will help illustrate how reward-action patterns can be very context-dependent.

Mechanisms of Collective Influence

I'm also trying to understand better how this 'collective consciousness' can influence individual reward systems. This involves looking at things like social norms, laws, and how our reputations can be affected when our actions go against the values of a larger group. These are some of the ways broader societal values can push back against reward systems that are only effective in limited settings.

Further Research Needed

To make the research more comprehensive, I'll be looking for more specific examples of reward systems in historical empires and dictatorships and how these systems might have contributed to their eventual downfall. I also want to find more direct research that shows how reward strategies that work in a small context can fail when applied more widely. This might involve searching for studies on the limitations of certain behavioral interventions across different cultures or societies.

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RLHF Mirrors Human Rewards

I've confirmed that the way AI models learn through Reinforcement Learning from Human Feedback is indeed very similar to how our own reward systems work. The AI learns what we prefer based on our feedback, guiding its behavior, just like our experiences shape what we find rewarding and how we act. It's interesting to see how complex it is to capture all the different preferences humans have in a single AI model, much like the diverse factors influencing our own motivations.

Examples of Specific Contexts

I've found several examples of 'niche environments' that help illustrate how certain behaviors and reward systems can be effective in specific situations. These include ecological niches where resources and interactions define success, business niches focusing on specialized markets, and social niches defined by the roles we play. These examples show how context strongly influences what is rewarded and what behaviors thrive.

Collective Values Shape Behavior

My research has shown how 'collective consciousness' influences us through shared beliefs, values, and social norms. This collective influence, built through socialization and cultural transmission, helps maintain social order, guides our behavior, and can even drive collective actions. It's a powerful force that can impact how our individual reward systems function within a larger society.

Historical Reward Systems

I've also looked into reward systems in the Roman Empire and Nazi Germany. In Rome, rewards like recognition and honors motivated soldiers, while elites gained prestige through public service. In contrast, Nazi Germany used rewards, including horrific ones, to incentivize support for their regime. These historical examples provide insights into how different societies have used reward mechanisms.

Limits of Broad Application

I've found information explaining why behavioral approaches that work in some situations might not be effective when applied more broadly. Factors like the desire for respect in adolescents can limit the success of general interventions. Similarly, what motivates employees in one culture might not work in another, highlighting the need for tailored and context-aware reward strategies.

Finalizing the Research

Having gathered more in-depth information and specific examples across these areas, I feel I have a comprehensive understanding of the topics. I will now move on to synthesizing these findings and writing the final report.

The Influence of Life Experiences on Human Reward Systems: A Contextual Analysis

1. **Introduction: The Interplay of Experience and Reward in Human Behavior**

The actions and choices individuals make throughout their lives are fundamentally shaped by reward systems that operate on both biological and psychological levels.[1] These systems, which manage feelings of pleasure and reinforcement, are activated by a wide array of experiences, extending far beyond the satisfaction of basic physiological needs such as hunger or thirst.[1] The human capacity for reward encompasses social interactions, achievements, learning, and a multitude of other stimuli that contribute to a sense of well-being and motivation.[2] Understanding how these reward systems develop and function requires a comprehensive examination of

the various contexts in which an individual is embedded from birth, including their social circles, political environment, physical surroundings, and family dynamics.[4] This intricate interplay between internal reward mechanisms and external contextual influences highlights a complex developmental process where inherent predispositions are continuously shaped by the environment.[4]

A contemporary lens through which to examine these reward mechanisms is the field of artificial intelligence, particularly the technique of Reinforcement Learning from Human Feedback (RLHF) used in training Large Language Models (LLMs).[7] This approach, where human preferences serve as a crucial feedback signal to refine the model's behavior, offers a compelling analogy to how experiences in human life act as feedback, reinforcing certain behaviors and shaping individual reward systems.[7] This report will delve into the definition of human reward systems from psychological and behavioral science perspectives, analyze the profound influence of social, political, environmental, and familial contexts on their development, and explore the analogy with RLHF. Furthermore, it will examine the concept of "niche environments" and their impact on reward-action logics, discuss the interaction between individual reward systems and the broader "collective consciousness," analyze historical examples of empires and dictatorships through the lens of their reward systems, investigate the limitations of universally applying reward logics effective in narrow contexts, and finally, consider interdisciplinary research efforts aimed at understanding the dynamics and scalability of these systems.

2. Defining the Human Reward System: A Psychological and Behavioral Science Perspective

At its core, the human reward system is a complex network of brain structures and neural pathways responsible for managing feelings of pleasure and reinforcement, with dopamine acting as a central neurotransmitter.[1] Key components of this system include the ventral tegmental area (VTA), which produces dopamine in response to rewarding stimuli; the nucleus accumbens (NAc), where dopamine release creates pleasurable sensations; and the prefrontal cortex (PFC), involved in evaluating the potential outcomes of actions and controlling impulses related to rewards.[3] The hippocampus plays a crucial role by linking rewarding experiences to memories, while the amygdala contributes to the emotional aspects of reward.[3] Enjoyable experiences, such as eating palatable food, engaging in social interaction, or experiencing sexual intimacy, activate this intricate system, motivating individuals to repeat behaviors that are essential for survival and well-being.[2] Beyond dopamine, other neurotransmitters like norepinephrine also modulate reward-related behaviors by influencing arousal and alertness.[3] This biological framework serves to increase the likelihood of survival

and reproduction by causing associative learning, eliciting approach and consummatory behavior, and triggering positively-valenced emotions.[2]

From a behavioral science perspective, reward functions as a positive reinforcer in operant conditioning, a process where the addition of a desirable stimulus after a behavior increases the probability of that behavior occurring again in the future.[2] Rewards can be broadly categorized as primary or intrinsic, which are inherently pleasurable and satisfy basic biological needs like food and sex, and secondary or extrinsic, which become rewarding through association with primary rewards, such as money or social approval.[2] The effectiveness of rewards lies in their capacity to produce associative learning, where individuals learn to link specific stimuli and actions with positive outcomes.[2] For instance, the satisfaction derived from eating a meal leads to the association of that action with the feeling of fullness and pleasure, making the individual more likely to seek food when hungry in the future.[10]

It is crucial to recognize that the experience of reward is not solely a biological or behavioral phenomenon but is deeply subjective.[4] What one individual finds rewarding can differ significantly from another based on a multitude of factors, including their unique neurochemistry, current physiological state (homeostasis), genetic predispositions, environmental influences, and epigenetic modifications.[4] Furthermore, memory plays a vital role in shaping the perception of reward.[3] The hippocampus, critical for memory formation, helps individuals recall past rewarding events and anticipate future rewards, thereby influencing their motivation and behavior.[3] This subjective and context-dependent nature of reward underscores the complexity of understanding how life experiences act as a reward system for individuals.

3. **The Cradle of Reward: Influence of Early Life Contexts**

The development of an individual's reward system is profoundly influenced by the contexts of their early life, particularly their familial and environmental surroundings.[5] Within the family unit, parental behaviors serve as some of the earliest and most influential rewards, shaping a child's initial understanding of positive reinforcement.[6] Acts of praise, affection, and the provision of resources by parents act as positive consequences that reinforce desired behaviors in children, making them more likely to repeat those actions in the future.[6] This consistent rewarding of certain behaviors forms the foundation of a child's developing reward system, teaching them what actions are valued within their immediate social environment.

Conversely, experiences of family conflict and adversity during childhood can have detrimental effects on the development of reward sensitivity.[18] Children who are

exposed to high levels of conflict or maltreatment may exhibit a diminished capacity to experience social reward and may not respond to positive social stimuli in the same way as their peers.[18] This altered reward processing can have long-term implications for their emotional well-being, potentially increasing their vulnerability to mental health challenges such as depression and addiction.[18] Furthermore, the cultural values and the sense of family identity instilled during upbringing can also modulate how individuals respond to rewards, particularly in the context of prosocial behavior within the family.[22] In some cultural contexts, contributing to the well-being of the family unit might be perceived as more rewarding than individual achievements. The establishment of consistent and age-appropriate reward systems within the family is crucial for fostering positive habits and promoting healthy development in children.[6] Clear expectations and predictable rewards can effectively motivate children to adopt desired behaviors and routines, contributing to a stable and supportive environment.

Beyond the family, broader environmental factors, such as socioeconomic status (SES), also play a significant role in shaping reward sensitivity.[5] Research suggests that children raised in lower SES environments may develop a dampened neural response to rewards compared to their peers from higher SES backgrounds.[5] This reduced sensitivity might be an adaptive response to an environment where rewards are often scarce and inconsistently available, leading the brain to become less attuned to their occurrence.[5] Additionally, the overall richness and stimulation of the rearing environment can impact reward-related behaviors. Studies on animals have indicated that those raised in enriched environments might exhibit differences in reward discrimination and impulsivity compared to those reared in more isolated conditions.[23] Early exposure to diverse social interactions and stimuli is also essential for the development of social reward processing, enabling individuals to effectively interpret and respond to social cues of approval and acceptance.[24]

4. **Navigating the Social and Political Landscape: External Contexts and Reward Mechanisms**

The development and function of individual reward systems are also profoundly shaped by the broader social and political landscapes in which individuals live.[24] Social norms and interactions play a crucial role, as social rewards, such as praise, approval, and social validation, have been shown to activate the same neural circuitry in the brain as non-social rewards like money or food.[24] The context of social interactions, including the nature of relationships, can further modulate reward system activity.[27] For instance, the act of sharing rewards with close friends elicits a stronger response in brain regions associated with reward compared to sharing with strangers, highlighting the rewarding nature of social connection.[27] Moreover, social

influence plays a significant role in shaping an individual's attitudes and preferences regarding reward-related decisions, demonstrating the powerful impact of the social environment on behavior.[27] Within these broader social structures, individuals often find their place in "social niches," which can be considered social comfort zones where specific roles and behaviors are reinforced through social rewards and a sense of belonging.[28] These niches provide a sense of safety, agency, and predictability, allowing individuals to operate with relative ease and low cognitive effort.[28]

Political structures and power dynamics also exert a considerable influence on reward systems, both within organizations and at the societal level.[26] In workplaces, organizational politics can significantly affect how rewards are allocated, potentially prioritizing factors like loyalty or personal connections over merit or performance.[26] This can shape employee behavior by incentivizing politically savvy actions rather than those directly contributing to organizational goals.[26] At a broader societal level, government policies and political contexts directly impact the design and implementation of reward systems through labor laws, minimum wage regulations, and the provision of social benefits.[31] These political decisions can influence employee motivation, job satisfaction, and overall economic behavior.[34] Furthermore, political systems themselves often utilize reward mechanisms, such as appointments to positions of power or the granting of lucrative contracts, to maintain the loyalty and support of key individuals and groups, thereby consolidating power.[37] The interplay between social norms, political structures, and individual reward systems underscores the complex web of influences that shape human behavior and motivation.

5. **Drawing Parallels: Human Experience as Reward in the Realm of Artificial Intelligence**

The process of Reinforcement Learning from Human Feedback (RLHF) in Large Language Models (LLMs) offers a compelling analogy to understanding how human experiences act as a reward system.[7] RLHF is a technique used to fine-tune LLMs so that their outputs align with human preferences and values.[7] This process typically involves three key steps: first, collecting human feedback on different responses generated by the LLM for a given prompt; second, training a separate "reward model" to predict which responses humans prefer; and third, using this reward model as a reward function to further fine-tune the LLM's policy through reinforcement learning algorithms like Proximal Policy Optimization (PPO).[7] The reward model learns to assign higher scores to responses that humans deem more helpful, harmless, and honest, effectively teaching the LLM what constitutes a desirable output.[8]

A direct analogy can be drawn between this process and how human experiences

shape individual behavior.[7] In RLHF, human feedback (preferences) guides the LLM to produce better responses. Similarly, in human life, positive and negative experiences act as feedback, guiding individuals to repeat behaviors that lead to positive outcomes and avoid those that result in negative ones.[39] The LLM learns to generate outputs that humans prefer by adjusting its internal parameters to maximize the "reward" signal from the reward model. This mirrors how individuals learn to behave in ways that elicit positive reinforcement (rewards) from their social environment and avoid negative consequences.[39] The concept of "alignment" in AI, where the goal is to make the model's behavior consistent with human values, is akin to the socialization process in humans, where individuals learn and internalize societal norms and values that guide their behavior.[7]

Within RLHF, there exists a spectrum of guidance, ranging from strict to more free approaches.[39] Strict guidance involves training the model on specific desired outputs, providing clear examples of what is considered good and bad.[39] This can lead to models that excel at specific tasks but might lack creativity or the ability to generalize to novel situations.[42] On the other hand, approaches with more freedom, such as those employed in models like DeepSeekV3, might involve learning from less structured human preferences or using self-play with a reward mechanism focused on the final outcome, often referred to as a sparse reward.[41] DeepSeekV3 utilizes techniques like Generative Reward Models (GenRM) and Reasoning Task Verifiers (RTV) to provide potentially less prescriptive feedback, allowing the model more autonomy in finding solutions.[44] This balance between strict and free guidance in RLHF mirrors the challenges in human development and education, where finding the right mix of structure and freedom is crucial for fostering both competence and creativity.[47] Too much control can stifle exploration, while too little might lead to undesirable or misaligned behaviors.[42]

6. **The Confines of Context: Reward-Action Logics in Niche Environments**

In sociology and psychology, the concept of "niche environments" refers to specific contexts characterized by their own unique set of rules, norms, and reward structures.[28] A niche can be understood as a particular position or function within a larger community or environment that provides the necessary resources and conditions for an individual or group to thrive.[30] These can range from specific subcultures or online communities to professional fields with their own distinct hierarchies and systems of recognition.[28] For instance, a highly specialized online forum dedicated to a particular hobby will likely have its own set of norms regarding communication, expertise, and what constitutes valuable contributions, with corresponding social rewards for those who adhere to these norms.[28] Similarly, within

a specific academic discipline, the reward system might heavily favor publications in top-tier journals and the acquisition of prestigious grants.

Within these limited contexts, certain reward-action logics can be exceptionally effective because they are closely aligned with the specific values, priorities, and goals of the niche.[50] Actions that are highly valued within the niche are likely to be met with significant rewards, reinforcing those behaviors among its members.[51] For example, in a competitive sales team, a reward system that heavily emphasizes individual sales targets and commissions will likely drive behaviors aimed at achieving those targets.[50] The concept of "niche construction" further elucidates this dynamic, suggesting that individuals or groups actively participate in shaping their environment to reinforce their preferred reward systems.[52] This involves modifying the environment, whether it be physical or social, to create conditions that favor their survival, success, or the propagation of their values and behaviors.[53] This can include establishing specific rules, norms, and reward structures that incentivize particular actions and attributes within that niche.[52]

7. **Beyond Individual Experience: The Role of Collective Consciousness in Shaping Rewards**

The "collective consciousness," a concept introduced by Émile Durkheim, refers to the shared beliefs, values, norms, and symbols that act as a unifying force within a society, shaping its collective identity.[56] It represents the collective understanding of social reality, providing a common framework for interpreting the world and coordinating social action among its members.[56] This shared consciousness profoundly influences what is generally considered rewarding within a society.[56] Societal values, often deeply rooted in the collective consciousness, dictate what kinds of actions and achievements are deemed worthy of praise, recognition, and other forms of reward.[56] For instance, a society that places a high value on community service might publicly honor individuals who dedicate their time to volunteer work.

The collective consciousness can either reinforce or challenge individual or localized reward systems when these are projected onto a broader scale.[60] If an individual's personal reward system or the reward system operating within a specific niche aligns with the prevailing norms and values of the collective consciousness, it is more likely to be supported and validated by the wider society.[60] However, when these localized reward systems clash with the broader societal values held within the collective consciousness, it can lead to tension, conflict, and potentially the delegitimization or suppression of the localized system.[60] For example, a subculture that rewards behaviors considered harmful or unethical by the mainstream society might face

social ostracism or legal repercussions.[62] This highlights the potential for conflict between individual desires for reward and the moral and ethical standards upheld by the collective consciousness.[62] The collective consciousness is not a static entity; it is continuously shaped and maintained through processes of socialization and cultural transmission, where shared beliefs and values are passed down from one generation to the next through various social institutions and practices.[56]

8. **Historical Perspectives: Reward Systems in Empires and Dictatorships and the Seeds of Their Decline**

Throughout history, empires and dictatorships have employed various reward systems to consolidate and maintain their power.[67] The Roman Empire, for example, utilized a hierarchical system of rewards that included military honors, political appointments, and the distribution of wealth acquired through conquest to incentivize service and loyalty to the state.[70] Similarly, Nazi Germany implemented a complex system of rewards ranging from promotions within the party and military to material benefits and even perverse "rewards" for participation in the atrocities of the Holocaust, such as alcohol and the plundered possessions of victims.[75] These regimes often leveraged a combination of material incentives, social status, and ideological appeals to motivate their supporters and maintain control over the population.[69]

The eventual decline of these empires and dictatorships can often be attributed, in part, to a misalignment or clash between their imposed reward systems and the broader societal values or the evolving collective consciousness of the people they governed.[80] The Roman Empire's decline was influenced by factors such as political instability, corruption, and economic inequality, which can be interpreted as failures of its reward system to ensure justice and stability for all its citizens.[80] The brutal and inhumane reward system of Nazi Germany, based on racial hatred and violence, ultimately stood in stark opposition to fundamental human values, contributing significantly to its downfall.[78] Furthermore, authoritarian regimes often face a critical trade-off between loyalty and competence when designing their reward systems.[67] While prioritizing loyalty might ensure the ruler's immediate safety, it can lead to inefficiency and poor governance in the long run if competent individuals are overlooked or even punished for perceived disloyalty.[67] This inherent tension can sow the seeds of instability and ultimately contribute to the regime's decline.

9. **The Limits of Universality: When Niche Rewards Fail on a Broader Scale**

Empirical evidence and theoretical arguments suggest that reward-action logics that prove effective within narrow, niche environments often fail to achieve the same success when applied universally across diverse contexts.[86] For instance, the

rational-legal model of organizational structure, while historically influential, has been shown to not accurately reflect the complexities of how organizations actually function in practice.[87] Similarly, management theories or "hypes" that are presented as universal solutions often prove ineffective or even counterproductive when implemented without careful consideration of the specific organizational culture and context.[88]

The effectiveness of reward systems is highly dependent on individual differences, cultural variations, and a multitude of contextual factors.[91] Reward practices that align well with the prevailing cultural norms and values of one nation might be ineffective or even detrimental in another.[91] For example, reward systems emphasizing individual achievement might be more effective in individualistic cultures, while those focusing on group performance might be better suited to collectivist societies.[91] This cultural sensitivity underscores the limitations of applying a standardized reward system across diverse populations. Furthermore, generalized behavioral interventions often exhibit limited success compared to individualized approaches that take into account the specific context and unique needs of individuals.[97] Functional Behavior Assessments (FBA), for example, highlight the importance of developing tailored interventions based on a thorough understanding of the individual's specific behavioral patterns and the environmental factors that influence them, as opposed to relying on broad, universal strategies.[97] The failure of many traditional preventative interventions for adolescents, which do not adequately address their desire for respect and status, further illustrates the limitations of generalized approaches.[98] Applying reward systems without considering the broader ecosystem of values and norms can also lead to unintended and negative consequences.[62] A reward system that solely focuses on maximizing short-term profits, for example, might inadvertently incentivize unethical behavior or damage long-term sustainability if it disregards broader societal values and environmental concerns.

10. **Interdisciplinary Insights: Towards a Holistic Understanding of Reward Systems and Their Scalability**

Gaining a comprehensive understanding of the dynamics and scalability of reward systems necessitates an interdisciplinary approach that integrates knowledge and methods from various fields, including psychology, sociology, political science, and artificial intelligence.[100] Psychology offers crucial insights into individual motivation, learning, and behavior in response to rewards.[14] Sociology provides frameworks for understanding social norms, collective behavior, and the influence of social structures on reward systems.[56] Political science examines power dynamics, governance, and the role of political institutions in shaping reward distribution and their impact on societal

behavior.[26] Increasingly, artificial intelligence and computational modeling are being utilized to simulate and analyze complex social behaviors related to reward systems, offering new tools for understanding their dynamics and potential outcomes.[100]

Interdisciplinary research allows for a more holistic analysis of the multifaceted factors that influence reward systems and their scalability.[101] By combining the strengths of different disciplines, researchers can develop more nuanced models that capture the intricate interplay between individual psychology, social context, political structures, and environmental influences in shaping how reward systems function at different levels of analysis.[101] For instance, understanding the scalability of a reward system designed for a small online community to a large, diverse society requires considering not only individual motivations but also the complexities of social norms, cultural differences, and the potential for unintended consequences at a larger scale. Interdisciplinary collaborations can help identify potential challenges and facilitate the development of more robust and adaptable reward systems for both human societies and artificial agents.[100]

11. Conclusion: Synthesizing Human and Artificial Reward Mechanisms

In conclusion, experiences in human life act as a multifaceted reward system, deeply intertwined with the social, political, environmental, and familial contexts of an individual's upbringing. This report has explored the fundamental principles of the human reward system from biological and behavioral perspectives, highlighting the crucial role of dopamine and reinforcement learning. The profound influence of early life experiences, social interactions, political structures, and environmental factors in shaping these reward systems has been examined, underscoring the dynamic interplay between internal mechanisms and external contexts. The analogy drawn with Reinforcement Learning from Human Feedback in Large Language Models provides a valuable framework for understanding how feedback, whether from human evaluators or life experiences, drives learning and behavior modification in complex systems.

The analysis of "niche environments" reveals the context-dependent nature of reward-action logics, demonstrating that what is effective in a limited setting might not translate universally. The role of "collective consciousness" in shaping societal values and influencing the legitimacy of individual or localized reward systems further emphasizes the complexity of this phenomenon. Historical examples of empires and dictatorships illustrate how reward systems have been used to maintain power, but also how their misalignment with broader societal values can contribute to their decline. Empirical evidence underscores the limitations of applying reward logics universally, highlighting the importance of considering individual differences, cultural

variations, and specific contextual factors. Finally, the growing recognition of the need for interdisciplinary research, combining insights from psychology, sociology, political science, and artificial intelligence, points towards a more holistic and nuanced understanding of reward systems and their scalability. Future research could fruitfully explore the ethical implications of designing reward systems in both human and artificial contexts, as well as investigate the long-term effects of various reward structures on individual and societal well-being.

Brain Regions	**Key Neurotransmitters**	**Primary Functions**
Ventral Tegmental Area (VTA)	Dopamine	Produces dopamine in response to rewarding stimuli.
Nucleus Accumbens (NAc)	Dopamine	Receives dopamine, creating feelings of pleasure and reinforcement.
Prefrontal Cortex (PFC)	Dopamine, Norepinephrine	Regulates decision-making processes involving rewards, controls impulses, and modulates reward-related behaviors.
Hippocampus		Links rewarding experiences to memories, recalls past rewarding events, and anticipates future rewards.
Amygdala		Contributes to the emotional aspects of reward.

Approach	**Examples**	**Level of Human Input**	**Potential Benefits**	**Potential Drawbacks**
Strict Guidance	Training on specific desired outputs	High; detailed feedback on desired behaviors	High control over specific behaviors, easier to ensure safety for narrow tasks	Limited creativity and exploration, might not generalize well, can be labor-intensive

Free Guidance	DeepSeekV3 using GenRM and RTV, self-play with sparse rewards	Potentially lower initially; reward focused on final outcome or more nuanced signals	Encourages exploration and creativity, potential for emergent reasoning	Risk of misalignment, reward hacking, requires robust reward mechanisms

Empire/Dictatorship	**Key Reward Systems Employed**	**Reasons for Decline**
Roman Empire	Military honors, political appointments, wealth from conquest	Political instability, corruption, economic inequality, overreliance on mercenaries lacking loyalty.
Nazi Germany	Promotions within party/military, material benefits, "rewards" for genocide	Clash with universal human values, unsustainable ideology, reliance on violence and oppression.

Referências citadas

1. discoverhealthgroup.com, acessado em abril 12, 2025, https://discoverhealthgroup.com/addiction/reward-system/#:~:text=The%20reward%20system%20comprises%20brain,addictive%20substances%2C%20activate%20this%20system.
2. Reward system - Wikipedia, acessado em abril 12, 2025, https://en.wikipedia.org/wiki/Reward_system
3. Reward System: Function, Addiction Impact, and Genetics - Discover Health Group, acessado em abril 12, 2025, https://discoverhealthgroup.com/addiction/reward-system/
4. The Brain's Reward System in Health and Disease - PMC - PubMed Central, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC8992377/
5. How the brain responds to reward is linked to socioeconomic background | MIT News, acessado em abril 12, 2025, https://news.mit.edu/2024/how-brain-responds-reward-socioeconomic-background-0122
6. Positive Reinforcement: The Benefits for Family and Parenting Coaching - Quenza, acessado em abril 12, 2025, https://quenza.com/blog/positive-reinforcement/
7. Reinforcement Learning From Human Feedback (RLHF) For LLMs - neptune.ai, acessado em abril 12, 2025, https://neptune.ai/blog/reinforcement-learning-from-human-feedback-for-llms

8. What is RLHF? - Reinforcement Learning from Human Feedback Explained - AWS, acessado em abril 12, 2025, https://aws.amazon.com/what-is/reinforcement-learning-from-human-feedback/
9. Exploring Reinforcement Learning from Human Feedback (RLHF): A Comprehensive Guide, acessado em abril 12, 2025, https://kili-technology.com/large-language-models-llms/exploring-reinforcement-learning-from-human-feedback-rlhf-a-comprehensive-guide
10. Reward Pathway Of The Brain: Definition, Function, And Role In Addiction, acessado em abril 12, 2025, https://valleyspringrecovery.com/addiction/drug/science-brain/reward-system/
11. Brain Reward System - Simply Psychology, acessado em abril 12, 2025, https://www.simplypsychology.org/brain-reward-system.html
12. Behavioral Reward Systems Explained, acessado em abril 12, 2025, https://rewardtheworld.net/behavioral-reward-systems-explained/
13. Reward: What Is It? How Can It Be Inferred from Behavior? - NCBI, acessado em abril 12, 2025, https://www.ncbi.nlm.nih.gov/books/NBK92792/
14. Positive Reinforcement and Operant Conditioning - Verywell Mind, acessado em abril 12, 2025, https://www.verywellmind.com/what-is-positive-reinforcement-2795412
15. Positive Reinforcement in Psychology (Definition + Examples), acessado em abril 12, 2025, https://positivepsychology.com/positive-reinforcement-psychology/
16. Reinforcement and Punishment – General Psychology - UCF Pressbooks - University of Central Florida, acessado em abril 12, 2025, https://pressbooks.online.ucf.edu/lumenpsychology/chapter/operant-conditioning/
17. 10 Do's and Don'ts for Using Rewards to Improve Your Child's Challenging Behavior, acessado em abril 12, 2025, https://thechildhoodcollective.com/2021/10/13/10-dos-and-donts-for-using-rewards-to-improve-your-childs-challenging-behavior/
18. Diminished social reward in children who have experienced adversity, acessado em abril 12, 2025, https://aifs.gov.au/resources/practice-guides/developmental-differences-children-who-have-experienced-adversity-guide-no2
19. (PDF) The longitudinal role of family conflict and neural reward sensitivity in youth's internalizing symptoms - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/372859270_The_longitudinal_role_of_family_conflict_and_neural_reward_sensitivity_in_youth's_internalizing_symptoms
20. longitudinal role of family conflict and neural reward sensitivity in youth's internalizing symptoms | Social Cognitive and Affective Neuroscience | Oxford Academic, acessado em abril 12, 2025, https://academic.oup.com/scan/article/18/1/nsad037/7235812
21. Associations between parental conflict and social and monetary reward responsiveness in adolescents with clinical depression, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9771890/
22. Gaining while giving: An fMRI study of the rewards of family assistance among

White and Latino youth - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC3079017/
23. Environmental Rearing Effects on Impulsivity and Reward Sensitivity - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC3906647/
24. The Social Brain and Reward: Social Information Processing in the Human Striatum - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC3890330/
25. Prediction-error in the context of real social relationships modulates reward system activity, acessado em abril 12, 2025, https://www.frontiersin.org/journals/human-neuroscience/articles/10.3389/fnhum.2012.00218/full
26. Making the Best Out of Organizational Politics and Its Challenges - Staffbase, acessado em abril 12, 2025, https://staffbase.com/blog/organizational-politics/
27. Social Context and Reward Sensitivity Enhance Corticostriatal Function during Experiences of Shared Rewards - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC10614966/
28. Beyond the Comfort Zone: The Role of Niches in Personal and Social Transformation, acessado em abril 12, 2025, https://edgeofpossible.com/comfort-zone-niche-social-change/
29. Social niche specialization under constraints: personality, social interactions and environmental heterogeneity - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC3638446/
30. What is a niche? Know Definition, Importance, Meaning and Examples! - Testbook, acessado em abril 12, 2025, https://testbook.com/articles/what-is-a-niche
31. Navigating the new political landscape: Key changes for UK reward and benefits leaders, acessado em abril 12, 2025, https://benifex.com/resources/blog/navigating-the-new-political-landscape-key-changes-for-uk-reward-and-benefits-leaders
32. When politics pays: Factors influencing managerial compensation decisions - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/229613613_When_politics_pays_Factors_influencing_managerial_compensation_decisions
33. 13.4 Limiting the Influence of Political Behavior - Organizational Behavior | OpenStax, acessado em abril 12, 2025, https://openstax.org/books/organizational-behavior/pages/13-4-limiting-the-influence-of-political-behavior
34. The Role of Organizational Politics on The Relationship Between Human Resource Management Practices and Employee Performance, acessado em abril 12, 2025, https://ijsmr.in/doc/ijsmr06_107.pdf
35. Factors Impacting on Reward Systems: A Comparative Study between Public and Private Universities in Zimbabwe - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/287452167_Factors_Impacting_on_Reward_Systems_A_Comparative_Study_between_Public_and_Private_Universities_in_Zimbabwe

36. Sustainable Total Reward Strategies for Talented Employees' Sustainable Performance, Satisfaction, and Motivation: Evidence from the Educational Sector - MDPI, acessado em abril 12, 2025, https://www.mdpi.com/2071-1050/15/2/1605
37. political systems - Kids | Britannica Kids | Homework Help, acessado em abril 12, 2025, https://kids.britannica.com/kids/article/political-systems/390910
38. Fine-tune large language models with reinforcement learning from human or AI feedback, acessado em abril 12, 2025, https://aws.amazon.com/blogs/machine-learning/fine-tune-large-language-models-with-reinforcement-learning-from-human-or-ai-feedback/
39. Reinforcement Learning from Human Feedback [RLHF]: Explained - YourGPT, acessado em abril 12, 2025, https://yourgpt.ai/blog/general/reinforcement-learning-from-human-feedback
40. A Comprehensive Guide to fine-tuning LLMs using RLHF (Part-1) - Ionio, acessado em abril 12, 2025, https://www.ionio.ai/blog/a-comprehensive-guide-to-fine-tuning-llms-using-rlhf-part-1
41. DeepSeek-V3 Technical Report - The VITALab website, acessado em abril 12, 2025, https://vitalab.github.io/article/2025/02/11/DeepSeekV3.html
42. How RLHF Preference Model Tuning Works (And How Things May Go Wrong) - AssemblyAI, acessado em abril 12, 2025, https://www.assemblyai.com/blog/how-rlhf-preference-model-tuning-works-and-how-things-may-go-wrong
43. Understanding the Effects of RLHF on LLM Generalisation and Diversity - arXiv, acessado em abril 12, 2025, https://arxiv.org/html/2310.06452v2
44. Exploring Data Scaling Trends and Effects in Reinforcement Learning from Human Feedback - arXiv, acessado em abril 12, 2025, https://arxiv.org/html/2503.22230v3
45. The Road to General Intelligence: How Deep Seek's R1 is Changing the AI Landscape, acessado em abril 12, 2025, https://www.rfsafe.com/articles/ai/the-road-to-general-intelligence-how-deep-seeks-r1-is-changing-the-ai-landscape.html
46. This AI Paper from ByteDance Introduces a Hybrid Reward System Combining Reasoning Task Verifiers (RTV) and a Generative Reward Model (GenRM) to Mitigate Reward Hacking - MarkTechPost, acessado em abril 12, 2025, https://www.marktechpost.com/2025/04/01/this-ai-paper-from-bytedance-introduces-a-hybrid-reward-system-combining-reasoning-task-verifiers-rtv-and-a-generative-reward-model-genrm-to-mitigate-reward-hacking/
47. New study sheds light on how the brain learns to seek reward | Columbia, acessado em abril 12, 2025, https://zuckermaninstitute.columbia.edu/new-study-sheds-light-how-brain-learns-seek-reward
48. The Niche as a Theoretical Tool - Annual Reviews, acessado em abril 12, 2025, https://www.annualreviews.org/content/journals/10.1146/annurev.soc.32.061604.123118
49. How Individualized Niches Arise: Defining Mechanisms of Niche Construction, Niche Choice, and Niche Conformance - PMC, acessado em abril 12, 2025,

https://pmc.ncbi.nlm.nih.gov/articles/PMC9169896/
50. Origins of the Leadership Development Framework - Cleveland Consulting Group, acessado em abril 12, 2025, https://www.clevelandconsultinggroup.com/pdfs/leadership-development-framework.pdf
51. The cognitive niche: Coevolution of intelligence, sociality, and language | PNAS, acessado em abril 12, 2025, https://www.pnas.org/doi/10.1073/pnas.0914630107
52. Niche Construction and the Evolution of Leadership - Digital Commons at Texas A&M University-San Antonio, acessado em abril 12, 2025, https://digitalcommons.tamusa.edu/cgi/viewcontent.cgi?article=1025&context=hist_faculty
53. Niche Construction - Open Encyclopedia of Cognitive Science, acessado em abril 12, 2025, https://oecs.mit.edu/pub/xyn6l8i3
54. "Niche Construction: Implications for Human Sciences" in - Michael J. O'Brien - University of Missouri, acessado em abril 12, 2025, https://cladistics.coas.missouri.edu/assets/pdf_articles/2015-laland-and-obrien.pdf
55. Niche Construction: The Process of Opportunity Creation in the Environment, acessado em abril 12, 2025, https://www.researchgate.net/publication/229796558_Niche_Construction_The_Process_of_Opportunity_Creation_in_the_Environment
56. Collective Consciousness - Scholarly Community Encyclopedia, acessado em abril 12, 2025, https://encyclopedia.pub/entry/54900
57. Collective consciousness - Wikipedia, acessado em abril 12, 2025, https://en.wikipedia.org/wiki/Collective_consciousness
58. The Concept of Collective Consciousness, Defined - ThoughtCo, acessado em abril 12, 2025, https://www.thoughtco.com/collective-consciousness-definition-3026118
59. Collective Consciousness or Collective conscience - Sociology Plus, acessado em abril 12, 2025, https://sociology.plus/courses/emile-durkheim/lesson/collective-consciousness-or-collective-conscience/
60. collective consciousness - Chicago School of Media Theory, acessado em abril 12, 2025, https://csmt.uchicago.edu/glossary2004/collectiveconsciousness.htm
61. Aftereffects of self-control: The reward responsivity hypothesis - PMC - PubMed Central, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC8182659/
62. Rethinking Reward Systems: Fostering Collaboration Over Competition - Join The Collective, acessado em abril 12, 2025, https://www.jointhecollective.com/article/the-dilemma-of-reward-systems/
63. Sharing Reward Program Based on Face Consciousness in Social Media - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9115677/
64. (PDF) Collective and individual improvement activities: The role of reward systems, acessado em abril 12, 2025, https://www.researchgate.net/publication/235273288_Collective_and_individual_i

mprovement_activities_The_role_of_reward_systems
65. Durkheim's Collective Conscience | EBSCO Research Starters, acessado em abril 12, 2025, https://www.ebsco.com/research-starters/history/durkheims-collective-conscience
66. Collective memory: between individual systems of consciousness and social systems - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC10603192/
67. Dictators and Their Viziers: Endogenizing the Loyalty-Competence Trade-off, acessado em abril 12, 2025, https://harris.uchicago.edu/files/inline-files/Dictators%20&%20Viziers.pdf
68. Dictators and Their Viziers: Agency Problems in Dictatorships - Deep Blue Repositories, acessado em abril 12, 2025, https://deepblue.lib.umich.edu/bitstream/handle/2027.42/40121/wp735.pdf?sequence=3
69. Dictatorship - Wikipedia, acessado em abril 12, 2025, https://en.wikipedia.org/wiki/Dictatorship
70. Penalties and rewards in Roman army - imperium romanum, acessado em abril 12, 2025, https://imperiumromanum.pl/en/roman-army/penalties-and-rewards-in-roman-army/
71. Benefactors and the Poleis in the Roman Empire (Chapter 9) - Cambridge University Press & Assessment, acessado em abril 12, 2025, https://www.cambridge.org/core/books/benefactors-and-the-polis/benefactors-and-the-poleis-in-the-roman-empire/F4DA0212956D6F89EF6B11C619D606C1
72. slavery 029 - American Economic Association, acessado em abril 12, 2025, https://www.aeaweb.org/conference/2011/retrieve.php?pdfid=432
73. How Inequality Killed the Roman Republic - The Metasophist, acessado em abril 12, 2025, https://www.themetasophist.com/notes/how-inequality-killed-the-roman-republic
74. Roman Empire - Wikipedia, acessado em abril 12, 2025, https://en.wikipedia.org/wiki/Roman_Empire
75. Part 4B: Women's Camps and Brothels - Kupferberg Holocaust Center - CUNY, acessado em abril 12, 2025, https://khc.qcc.cuny.edu/camps/part-4b-womens-camps/
76. Bureau Competition and Economic Policies in Nazi Germany, 1933-39 - LSE, acessado em abril 12, 2025, https://www.lse.ac.uk/Economic-History/Assets/Documents/WorkingPapers/Economic-History/2004/wp8004.pdf
77. Causes and Motivations - United States Holocaust Memorial Museum, acessado em abril 12, 2025, https://www.ushmm.org/teach/teaching-materials/roles-of-individuals/ethical-leadership/causes-and-motivations
78. Drunk on genocide: how the Nazis celebrated murdering Jews | Aeon Ideas,

acessado em abril 12, 2025, https://aeon.co/ideas/drunk-on-genocide-how-the-nazis-celebrated-murdering-jews
79. Economy of Nazi Germany - Wikipedia, acessado em abril 12, 2025, https://en.wikipedia.org/wiki/Economy_of_Nazi_Germany
80. Decline of Ancient Greece and Ancient Rome, acessado em abril 12, 2025, https://www.edu.gov.mb.ca/k12/cur/socstud/foundation_gr8/blms/8-3-5e.pdf
81. Which three major factors contributed to the Roman Empires decline political insurrections military rebellions famine political instability military conflict ec, acessado em abril 12, 2025, https://www20.weaversway.coop/educa/520388
82. The Decline of the Roman Republic - Students of History, acessado em abril 12, 2025, https://www.studentsofhistory.com/the-decline-of-the-roman-republic
83. How Rome Destroyed Its Own Republic | HISTORY, acessado em abril 12, 2025, https://www.history.com/articles/rome-republic-augustus-dictator
84. History of the decline and fall of the roman empire | Green Line Tours, acessado em abril 12, 2025, https://www.greenlinetours.com/en/blog/tourist-information/history-decline-and-fall-roman-empire
85. The loyalty-competence tradeoff in dictatorships and outside options for subordinates., acessado em abril 12, 2025, https://economics.hse.ru/data/2014/10/09/1100971341/dictator_5.pdf
86. (PDF) Routledge International Handbook of Failure - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/367184832_Routledge_International_Handbook_of_Failure
87. Theoretical Approaches to Human Service Organizations, acessado em abril 12, 2025, https://us.sagepub.com/sites/default/files/upm-assets/29880_book_item_29880.pdf
88. The (Non)Sense of Organizational Change: An Essai about Universal Management Hypes, Sick Consultancy Metaphors, and Healthy Organization Theories - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/240279692_The_NonSense_of_Organizational_Change_An_Essai_about_Universal_Management_Hypes_Sick_Consultancy_Metaphors_and_Healthy_Organization_Theories
89. Why Economists Failed as “Experts”—and How to Make Them Matter Again, acessado em abril 12, 2025, https://www.ineteconomics.org/perspectives/blog/why-economists-failed-as-experts-and-how-to-make-them-matter-again
90. Nation Building Big Lessons from Successes and Failures | CEPR, acessado em abril 12, 2025, https://cepr.org/system/files/publication-files/181996-nation_building_big_lessons_from_successes_and_failures.pdf
91. (PDF) Rewards and Organizational Performance in Japan and the United States: A Comparison - ResearchGate, acessado em abril 12, 2025,

https://www.researchgate.net/publication/247756924_Rewards_and_Organizational_Performance_in_Japan_and_the_United_States_A_Comparison
92. Relationship between Organizational Culture, Leadership Behavior and Job Satisfaction - PMC - PubMed Central, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC3123547/
93. Impact of Culture on Incentive Systems - DiVA portal, acessado em abril 12, 2025, https://www.diva-portal.org/smash/get/diva2:421483/FULLTEXT01.pdf
94. Reward Strategies for Attacting, Evaluating and Retaining Professionals - USC Center for Effective Organizations, acessado em abril 12, 2025, https://ceo.usc.edu/wp-content/uploads/1984/12/1984_17-g84_17-Reward_Strategies.pdf
95. Organizational Psychology in Cross-Cultural Perspective - OAPEN Library, acessado em abril 12, 2025, https://library.oapen.org/bitstream/handle/20.500.12657/89376/9780814786581_WEB.pdf?sequence=1&isAllowed=y
96. (PDF) The cultural influence on employees' preferences for reward allocation rules: A two-wave survey study in 28 countries - ResearchGate, acessado em abril 12, 2025, https://www.researchgate.net/publication/366954564_The_cultural_influence_on_employees'_preferences_for_reward_allocation_rules_A_two-wave_survey_study_in_28_countries
97. Functional Behavioral Assessment-based Interventions - Institute of Education Sciences (IES), acessado em abril 12, 2025, https://ies.ed.gov/ncee/wwc/Docs/InterventionReports/wwc_fba_011017.pdf
98. Why Interventions to Influence Adolescent Behavior Often Fail but Could Succeed - PMC, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC5758430/
99. A review of empirical support for differential reinforcement of alternative behavior, acessado em abril 12, 2025, https://www.researchgate.net/publication/223245863_A_review_of_empirical_support_for_differential_reinforcement_of_alternative_behavior
100. Complex Social Behaviour Through the Lens of AI: - The Alan Turing Institute, acessado em abril 12, 2025, https://www.turing.ac.uk/sites/default/files/2025-02/the_alan_turing_institute_-_final_workshop_report_4_feb_complex_social_behaviour_through_the_lens_of_ai.pdf
101. Why, with whom, and how to conduct interdisciplinary research? A review from a researcher's perspective - Oxford Academic, acessado em abril 12, 2025, https://academic.oup.com/spp/article/52/2/165/7907587
102. Social Sciences and Interdisciplinary Behavior: The 4th International - Routledge, acessado em abril 12, 2025, https://www.routledge.com/Social-Sciences-and-Interdisciplinary-Behavior-The-4th-International-C/Bagautdinova-Hutagalung-Lumban-Gaol-Safiullin/p/book/9781138028388?_ga=940240082.1740960000
103. Interdisciplinary Team Science and the Public: Steps Towards a Participatory

Team Science - PMC - PubMed Central, acessado em abril 12, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC5973546/

104. Future Directions in Social Science - Basic Research, acessado em abril 12, 2025, https://basicresearch.defense.gov/Portals/61/Future%20Directions%20in%20Social%20Science_Final%20Report_12%20Aug%202019.pdf?ver=2019-09-24-114011-603