Exploring structure and agency in changing cook stove practices: Insights from the energy poor in rural India.

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Abstract

This paper discusses key learnings from an exploratory study on types of change occurring in energy related cook stove practice in rural India. Sharing these learnings is important for moving forward a research agenda on understanding how social practices such as cooking – and associated energy use behaviour – emerge, persist and change over time. The research draws on practice theory and contemporary literature on structure and agency to help make sense of how and why people use different energy fuels to achieve cook stove related demands. The study used an exploratory mixed methods approach, which was employed in two rural villages located in the Chittoor district of Andhra Pradesh, India. Preliminary findings reveal powerful structures at play that appear to 'lock-in' existing cooking practice, while also identifying innovations in practice that have emerged from complex agency-structure relationships. In order to further explore these findings and gain meaningful insight for the design of policies and interventions aiming to enact a social change, a greater depth of research is recommended to better understand how cooking related energy practices co-evolve over time.

Introduction

Within the field of energy poverty, it is widely accepted that the transition from traditional to modern energy fuels is a critical enabler of change for marginalized populations living in poverty (Bazilian, Sagar, Detchon, & Yumkella, 2010; Modi, McDade, Lallement, & Saghir, 2006; Sagar, 2005). Despite most advanced economies transitioning to modern energy sources such as electricity or gas many decades ago (Pachauri et al., 2012), two thirds of India's vast population continues to demand traditional fuels such as woody biomass (*fuelwood*) and animal dung to meet their most basic of energy needs such as cooking (World Health Organisation, 2016). In the Indian state of Andhra Pradesh specifically, 67 per cent of rural households continue to rely upon fuelwood for cooking purposes, which is predominantly collected from common pool forest reserves (Government of India, 2014). This practice negatively impacts people's health, wellbeing, livelihoods, and the ecosystems with which they depend (Bruce, Perez-Padilla, & Albalak, 2000; Gordon et al., 2014).

In this context, energy related practices routinely performed by people such as the collection of fuelwood and use of traditional cook stoves (*Chulha*) indicates a decision system that favours the status quo and deeply embedded within social norms. This suggestion is supported by studies that find a reluctance to abandon the traditional stove, indicating instead that most transitions amongst traditional energy using households follow a multiple stove strategy referred to as 'fuel stacking' (Cheng & Urpelainen, 2014; Masera, Saatkamp, & Kammen, 2000). This type of change could be considered an *incremental* shift in practice, whereby the 'essence and integrity of an incumbent system or process' is maintained (Park et al., 2012, p. 119). For the energy impoverished, we propose that a complete transition away from traditional practice and toward modern forms of energy demand represents a *transformational* shift – a major, purposeful action resulting in a fundamental shift in both underlying strategy and process.

Conceptualising different *types* of change processes is a useful frame to further understanding of the elements that enable or constrain social change. Investigating these elements with respect to cooking practices requires an intimate study of the individual, household and social level interactions with energy systems, an area of research recognised as a critical gap in literature (see for example, (Stern, 2014; Wilson & Dowlatabadi, 2007)). This research builds upon and extends recent social practice scholarship into the kitchens of rural India, embracing the worldview that energy demand is derived from, and for the purpose of accomplishing social practices (Warde, 2005). By focusing on the 'practice' of cooking and the people who enact it, rather than energy itself treated as an independent technical, social or economic system (Shove & Walker, 2014), insights gained from this style of social inquiry can offer richer insight for policy and programs designed to promote change at a scale required.

In order to help fill this gap in literature, this paper describes a trial mixed methods approach to explore these complex interactions underpinning different energy practices at the local level, and how these practices change over time. First, we explore the literature to present the current state of knowledge and what needs to be understood further. Then, the research process is described. The results of the analysis are then detailed and discussed. We conclude with a comment about the contribution of the study as well as providing suggestions for further research.

Literature Review

The Structure and Agency Debate

The structure-agency debate has troubled social scientists for many years and remains prolific amongst sociological theory (Howarth, 2013). The debate largely centres around whether individuals have the capacity to act independently as free 'agents' to do as one chooses, or if such behaviour is governed or dictated by powerful social 'structures'. The Durkheim perspective argues that structures (for example 'social facts', rules or regulations) define, coerce and exercise control over the conduct of human behaviour (Elder-Vass, 2010, p. 1). From this perspective, human agents are considered passive recipients of powerful structural influence determining actions of individuals. An alternative position emerged from scholars such as Max Weber in the mid-20th century, subsequently presenting frameworks in defence of the capability of agents to employ individual judgment, creativity, intention and calculation in order to create their environment in an agency centred perspective.

More recently, theoretical work has focused on the integration of these two perspectives. Giddens (1984) detailed the theory of structuration, an integrated framework that suggests a *duality*: (1) of structure, both as the medium and the outcome of practices, and (2) the influence of agents in shaping structure, together forming the explanation of social life and organization (Giddens, 1984). Similarly, Bourdieu (1977) stresses the importance of both structure and agency with the introduction of the concepts of *Habitus* (an individual's constructed norms and tendencies developed over time) and *Field* (the setting or context within which agents interact and relate). This trend toward an integrative approach recognising the inter-relationships between both structure and agency, has been observed in modern scholarship (see Lane (2001, p. 295) for a discussion). This modern, integrative perspective on structure and agency, particularly with reference to the work of Giddens (1984), is adopted and explored for the purpose of our study. But first we take a brief account of the different models of energy related behaviour found in literature.

Models of energy related behaviour

Common behavioural perspectives dominating recent literature generally follow the integrative approach to the structure and agency debate, emphasizing both factors in attempts to explain decision making and behaviour related to energy use. These different models can be found grounded within disciplines of conventional and behavioural economics, technological diffusion models, social psychology and sociological paradigms (Wilson & Dowlatabadi, 2007). While these models do share some characteristics, they often differ in many other respects such as their scale of focus, research methods of inquiry and decision parameters as indicated by their dependant and independent variables.

Table 1 below, adapted from Wilson and Dowlatabadi (2007), highlights some of these differences. To take an example, while microeconomic models focus at the individual level and emphasise the choices that people make (driven largely by personal preference and characteristics of technology), the diffusion of innovation models take this argument one step further to suggest that technology adoption is a social process influenced by such factors as peer effects and social networks. Models developed from within social psychology and sociology progressively lean towards explanations that emphasise social influence, with the typical method of inquiry more of a qualitative nature compared with methods employed by economic and technology focused models. We now introduce practice theory as an approach rooted within this sociological perspective and an integrative treatment of structure and agency, and describe its use in our study.

Table 1: Different models of energy related human behaviour and their main features

	Economics (conventional & behavioural)	*Technology diffusion*	*Social Psychology*	*Sociology*
Scale	Individual	Individual/social	Individual/social	Social
Research methods	Quantitative	Quant & qualitative	Quantitative & qualitative	Qualitative
Dependent variable	Preference/ choice	Rate of diffusion	Self-reports of behaviour	Self-reports & observed behaviour
Independent variable	Costs, benefits and decision frame	Social networks, tech attributes, leadership	Values, attitudes, norms, capabilities	Social, cultural and technical determinants
Goal/ target orientation	Design of incentive programs	Tech attributes and targeted segmentation	Attitude and personality relevant targeting	Sociotechnical regime change
Intervention timescale	Short term	Short-med term	Short-med term	Long term

Adapted from Wilson and Dowlatabadi (2007)

Energy behaviour as a social practice

Scholars of *practice theory* take a different approach to the economic and psychological traditions highlighted on the left hand side of Table 1 above that typically focus on the attitudes or choices of individuals. Instead, practice theory is situated within a sociological tradition and draws attention to the concept of *practices* as they are performed by individuals (Shove, Pantzar, & Watson, 2012, p. 99). This approach appeals because it does not focus solely on an individual, nor is it too holistic, and therefore capable of capturing a richer depiction of social order in heterogeneous and complex local contexts (Schatzki, 1996). A 'practice' (Praktik), as framed by Reckwitz (2002, p. 249) in the context of describing the whole of human action, is considered:

> *"...a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge."*

Shove et al. (2012, p. 23) build on the concept further, contending that practices are shaped by the links between three elements that can be distinctly identified as; materials (objects, infrastructure, tools and devices, or the 'hardware'), competencies (practical knowledge, understanding, 'software') and meaning (social and symbolic significance). The authors argue that practices emerge, persist, and change over time as the links between material arrangements, competencies and meaning are made, broken and then re-established in a dynamic process of changing practices over time. Rather than reducing the target of a particular policy or intervention to any one element such as changing behaviour, manipulating choice or through technical innovation alone, prescribers of practice theory argue that focusing on the dynamics of practices situated within its wider context offers greater insight for promoting shifts toward sustainable transitions.

Practice theory has become popular with energy scholars in recent times. Examples of its use can be found across a broad spectrum of energy related practice, including mobility and transport (Shove, Watson, & Spurling, 2015; Watson, 2012), building retrofits (Bartiaux, Gram-Hanssen, Fonseca, Ozolina, & Christensen, 2014; Hand, Shove, & Southerton, 2007), household comfort and energy efficiency (Gram-Hanssen, 2010, 2011), peak demand management (Strengers, 2011, 2012), pro-environmental behaviour (Hargreaves, 2011) and the adoption of information and communication technologies (Røpke, Haunstrup Christensen, & Ole Jensen, 2010). However, there remains limited examples in the literature of taking a practice-based approach to exploring cook stove related energy behaviour. This is despite suggestions that understanding cooking practices require a more complex theory of change than the traditional economic or technology-led models of behaviour will allow (Burwen, 2011, p. 31).

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For this study a practice-based framework was explored to address two research questions: (1) what are the distinguishable characteristics of different *types* of change occurring in cooking related energy practice; and (2) how does structure and agency influence these change processes emerging within cooking practices in an energy impoverished community.

Method

Mixed methods involving a survey instrument, individual interviews and focus group discussions (FGDs) were used to collect data. This approach was chosen to achieve both a degree of methodological triangulation (Cohen, Manion, & Morrison, 2011, p. 195), and to test various research methods as a pilot study for a larger research project.

The survey instrument was designed specifically to capture variables related to demography, energy use practice (fuel use, stove use and changes over time), as well as measures of perceived and desired states of human agency of local energy users. The agency component of the questionnaire was adapted from the Ryff Scales of Psychological Well-being (Ryff & Keyes, 1995). Twelve statements were chosen from the available 54 that reflect six areas of well-being: autonomy, environmental mastery, personal growth, positive relationships with others, purpose in life and self-acceptance. The Ryff scale was chosen because it captures general perceived agency and a broad range of factors we were particularly interested in; namely autonomy, environmental mastery and relationships with others.

A problem-solution tree mapping exercise (Hovland, 2005) was employed as a means of facilitating discussion for the FGDs and to explore the nature (specifically, cause and effects) of cooking fuel practices. The sessions were audio-recorded and the recordings transcribed from the local language (Telugu) to English for the purpose of analysis. Transcriptions and field notes were then processed using applied thematic analysis (Guest, MacQueen, & Namey, 2012) to identify codes and themes through the lens of a social practices theoretical framework.

Research site, demographics and energy use trends

We report on the findings from two villages (henceforth labelled Village 1 and Village 2) engaged in December, 2015, located in the district of Chittoor, Andhra Pradesh. Andhra Pradesh in India is recognised as a state with a high dependence on limited common property forest resources (Chopra & Dasgupta, 2002; Government of India, 2014), and hence an appropriate location for research.

Both villages are located within proximity to forest reserves. With the support of local staff of the Foundation for Ecological Security, the study team engaged between 25-30 village members across four FGDs in two different villages. Eight semi-structured individual

interviews were conducted with household members of traditional and modern energy practices.

At an initial community meeting, we grouped households according to their self-reported and observed cooking practices. In Village 1, all 50 households used a traditional stove for cooking and preparing food. Of these, ten reported using a combination of both traditional and modern stove such as liquefied petroleum gas (LPG), kerosene or an electric rice cooker *(incremental* shifts*)*. There were no reports of households in this village who had made a complete transition to modern cooking practices. We then used these groupings to invite members to participate further in the research.

Village 2 was located approximately 30 kilometres from Village 1, and consisted of 45 households. All of the households had reportedly abandoned traditional cooking practices and adopted modern fuels and stoves *(transformational* change*)*. Cooking practices in this village varied from the use of biogas units (39 households in 2010), solar cookers and more recently, the introduction of LPG stoves.

Results

We will now present the results of the analysis with a focus on six key themes that emerged from the coding of interview data and field notes. Table 2 below presents each of the themes with a short description and examples of quotations from the field for illustration. We describe each of the themes here before discussing our interpretation of the implications on the different types of change processes occurring in cook stove related practices in rural India.

Accessibility

Narratives with traditional stove users suggest that the accessibility of energy sources may be an important factor influencing the type of change. Here, we define accessibility in a broad sense to include both material characteristics of the fuel source and aspects related to capability. In so doing we make an important distinction between availability – for example the practical limitations of obtaining, transporting and utilising a fuel source, and accessibility – one's ability to take advantage of the available supply for a purpose intended. For example, while gas bottles for an LPG stove may be available, the cost for purchasing may be prohibitive for some people who are constrained in financial capability.

When asked what were the main drivers for cooking with fuelwood, traditional cooks in a focus group discussion cited the ease to which one may access fuel from a nearby, unregulated (or un-enforced) local forest commons at little or no direct financial cost. For many people in the village, the collection of fuelwood was part of their weekly routine. Often fuelwood would be collected, mostly by women, either once or twice a week while they worked in the field and carried back on the return journey. The traditional indoor

stoves *(Chulha's)* found in the village are a U-shaped mud stove, maintained regularly with a coat of local clay and animal dung mixture to avoid cracking. There is little expenditure involved in the traditional cooking practice, from the purchase of the stove, maintenance, and the collection of locally sourced fuelwood.

Incremental adapters also noted the accessibility of fuelwood as a key factor, reinforcing and encouraging fuel stacking behaviour. However, there was an observable difference in attitude toward this between the two groups. While incremental adapters acknowledged the economic benefit of using traditional cook stoves compared with alternatives, the burden of the collection, and hence an indirect cost, appeared to weigh in on their cost-benefit decisions more so than traditional users.

Sufficiency

We use the term sufficiency here to describe perceptions of how well a particular fuel or stove achieves the energy needs as desired by those performing the action. Village members often described the practice of cooking not simply in terms of the stove itself or the process of preparing food for the family, but also the broader functions that the practice serves. Village members often refer to the practice of cooking in collective terms, suggesting an attachment of socialising and collective gatherings to cooking practices. The language used in the discussions during both individual interviews and in groups was often collective in nature, using a lot of 'we', 'us' and 'ourselves'. Furthermore, both incremental adapters and traditional users indicated a preference for the taste and overall quality of food that was cooked on a fuelwood stove, suggesting that alternative energy options simply did not fulfil that desirability in the same manner. We therefore attach the label of sufficiency to refer to unmet needs from a particular fuel choice with respect to taste, quality, and other functions of the cooking practice.

Sufficiency is also considered here in terms of both quantity and quality of fuel supply. Government-supported programs are available in Andhra Pradesh to encourage the use of LPG and kerosene stoves. This support includes discounts and rations of fuel supply, specifically targeted to households living below the poverty line. However, traditional users and incremental adapters noted that the quantity provided through these schemes is not sufficient to support the cooking task in an average home. The quality of electricity supply also provides a serious hindrance for the effective use of rice cookers. Villagers described frequent and unexpected outages in electricity supply that resulted in half-cooked rice, indicating concern that such events increase the risk of electrical fires.

Knowledge

The third theme that was extracted from the data refers to background knowledge, or lack thereof, and the influence of media. We refer to knowledge in the dual sense of both understanding the fuel and stove choices available, and the practical knowledge of how to

use them. Traditional users repeatedly indicated that they were unaware of alternative stoves, nor did they know how to use them. As a result, a level of suspicion and scepticism was expressed towards modern fuel choices such as LPG, kerosene or electric rice cookers, and the perceived safety of those alternatives.

Unravelling the safety concerns attributed to alternative stoves also revealed the influence of information flows such as media, in the way users construct meaning. When there is a lack of personal experience with alternative stoves, users look to other sources of informational to fill this knowledge gap. When quizzed about how a village member learned about unsafe practices with gas stoves, even without any prior personal exposure to such issues, the participant noted advertisements seen on TV that warned of safety concerns with LPG stove systems.

Motivation

Prior to 1982, all households in Village 2 were using traditional practices for cooking. Fuelwood was abundant and accessible, collected from a nearby forest located less than a mile from the village. Both men and women would play a role in the collection. Some men adopted a strategy of collecting large quantities of fuelwood at a time, often once per month, and stockpiling for its use over the course of the month. Village members recited in their stories the drudgery of such tasks, yet still the practice persisted. In 1982 two village members were caught by enforcement officers carrying fuelwood back to the village. This event triggered an emotional reaction and influenced their decision to consider alternative solutions.

In this context we codify such trigger events that mobilise a shift in practice under the theme of motivation, as an all-encompassing term to describe different forms and sources of motivational knowledge.

Personality

The narrative of how Village 2 transformed its cooking related energy practice provide some preliminary evidence that personality traits, in this particular case an appetite for risk, may play a role in the change process. After the two villagers found themselves with the motivational willpower to look to alternative solutions, they recalled seeing an advertisement in the newspaper detailing a government-supported program that helped to subsidise the purchase and installation of biogas units. Armed with this information, the villagers tapped into available social capital in the form of a relative who worked in a bank in the nearby town. This family member helped to arrange the personal loans for the units, making the transformation possible for the members. While the information and subsidy was available to all members of this community back in 1982, only three members came forward and applied for the subsidy. Two units were installed at that time due to space constraints for the third applicant.

It was also apparent that these people who have an appetite for risk in one aspect of their lives, also exhibit similar tendencies in others. One of the two early adopters of biogas stoves was also the first in the village to trial sericulture (silkworm cultivation), organic tomato farming, while also being the first person in the village to purchase a radio. It was observed that this member's house was very unique in the village, one of only two houses to have installed a second story on the roof to accommodate an expanding family.

This appetite to take risks and try something new also seemed to permeate throughout the village. In our focus group discussion, village members raised some safety concerns related to solar cookers in particular. When asked to elaborate, the villagers made the case using an analogy of crossing the road, that with careful management of such risk accidents can be avoided. This collective identity with respect to risk taking leads to the sixth and final theme coded through the analysis of data.

Aspiration

We refer to aspiration here in both collective and the individual terms. By 2010, every household in Village 2 had abandoned the traditional cook stove and made a complete transformation to alternative cooking practices. 39 biogas units had been installed in the village, and many others had adopted solar cookers. Village members recall this event as a momentous occasion for them, proudly announcing their community as the first 'smokeless village' in the region.

This example of collective aspiration has worked to favour the community in this transformation. Signals suggesting this is a village open and willing to take risks attracted the attention of an NGO who subsequently worked with the village to achieve their goal of becoming the first village in the area to completely abandon traditional cooking practices.

Table 2: Identified themes, descriptions and quotations related to change processes in cook stove practices

Theme	Description	Quotations from the field
Accessibility	The convenience and ability to obtain, transport and use a fuel source or stove for the purpose of satisfying an energy demand.	"There is no expenditure with firewood stoves." "Firewood is easily available to us at a nearby place."
Sufficiency	Level of satisfaction that a particular fuel or stove achieves an energy service as desired by those performing the action.	"During winter and rainy seasons, we enjoy sitting before the firewood stove and make ourselves warm." "Rice or any food cooked on firewood stove is very tasty compared to other fuels."
Knowledge	Limited personal exposure to alternative practices leave users to construct meaning and interpretation.	"We don't know how to use LPG so we prefer firewood stove." "Because we don't know how to use it and we are afraid of the safety."
Motivation	Certain trigger events and other forms of motivational knowledge can encourage a shift in practice, however such a shift may be more gradual than sudden.	"We were caught by the forest [officials] when we were bringing firewood. We felt ashamed."
Personality	Personality traits such as an appetite for risk and willingness to try new things was prevalent amongst the early adopters of new cook stove practices.	"We are taking all the required care and cautions. Crossing the road is also risky, yet still this does not stop us from walking. If we cross carefully risks can be avoided."
Aspiration	Personal aspiration may differentiate early adopters from the rest, but collective aspiration could be an important motivator of sustained social change.	"Everybody could have taken it but only two of us took it… as none was interested [or] had any idea about it." "Our village is called a Model Village and a smokeless village and it is found in Internet also. [We] feel great about it."

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Discussion

Structures reinforcing traditional cooking practices

Recall that material elements are the objects, infrastructures and devices that influence, and are subsequently influenced by, social practices. These material elements can be both natural phenomena or man-made fabrications such as environmental resources or technologies. From the analysis of data, we find multiple illustrations of how material arrangements, given life through practical knowledge (competence) and symbolic significance (meaning), reinforce traditional cooking practices. One prime example in this case is the availability of fuelwood conveniently located nearby and accessible to local villagers as a material arrangement related to natural resource. We may also consider the insufficient nature, perceived or otherwise, of the supply of electricity, kerosene or LPG fuel as replacement alternatives to be an infrastructure related material arrangement influencing change processes in cook stove choices.

The narrative surrounding the topic of information influence and safety suggest that it would be futile to attempt to disentangle the material world from competencies and meanings. In the case of traditional cook stove users, limited background knowledge of alternatives (competence) allowed space for perceptions of safety (meaning) to be constructed through information sources such as newspaper and TV advertisements (material). For incremental adapters, while group members noted that *"[o]n the whole, we feel firewood is not preferred anymore"*, it was evident that a number of structural forces and their linkages across material arrangements, competence and meaning, all play a role in reproducing traditional and fuel stacking practice and restraining members from making a transformational step to an alternative cooking practice. While in tact, such structural linkages that underpin traditional cooking practices will continue to reinforce the status quo.

Transformational change: innovations in practice

The narratives from the transformational change in Village 2 provide another good example of the linkages between meanings (aspiration and motivational knowledge) and competences (the skills and practical knowledge required to enact ideas and aspirations), and the relationship between these elements and the material world that drive transformations in practice. In the case of traditional practices, we discussed how information and media can become a structural influence reinforcing the status quo. For transformational adapters however, we find an example of how information and media can serve to promote and enable transformational change in the case of an advertised government-led biogas subsidy program. A desire to change practices (motivation)

alongside the capability to do so by drawing upon social and economic capital (competence) enabled two village members to act upon the biogas advertisement.

Our preliminary investigations indicate that motivation, personality, and aspiration may play a critical role in the transformation of cook stove practices. However, more in depth investigations are required to explore the role of these potentially influential factors in the transformational change process. This preliminary work has helped to frame the research and identify a number of questions that are worthy of further exploration. For example, how important are trendsetters and community mobilisers as important channels for promoting innovation in practice? How influential is collective aspiration verse individual aspiration in the social change process?

Conclusion

This paper presents findings from an exploratory study on change processes occurring in cooking practices in rural India. The aim of the study was to characterise these different types of change, and explore the role of structure and agency on driving these change processes.

Alongside traditional users, we observed actors who are taking incremental steps toward adaptation, transitioning to modern fuels but without abandoning traditional practices. This type of change indicates a practice that has emerged from new links formed between materials, competence and meaning, while old links remain intact. In this study we also observe actors who have made a transformational shift and embraced a complete transition to new cook stove technologies.

Exploring these different types of change, we identify structural forces at play that appears to reinforce traditional cooking practices. For both traditional users and incremental adapters, these strong links between materials, competence and meaning are promoting the reproduction of existing structures. We also find indications of innovations in practice that are driven by seemingly complex agency-structure relationships.

These results demonstrate the value of extending theories of social practices into new areas of energy related behaviour such as cooking practice, adding to the growing literature investigating social practices in relation to energy systems. In India specifically, these practices are currently in a dramatic state of flux as the country continues to transition toward a modern economy while the international community intensifies its efforts in alleviating energy poverty and encouraging sustainable development. As such, the study of energy related practices in India offers a unique opportunity for to explore these emergent patterns of change in real time.

While preliminary, the anecdotes provided through this study offers a platform for further research into what influences different types of change processes. This work is highly

relevant for the design of policy mechanisms and interventions aiming to promote and encourage transformational shifts toward modern cooking practices. Insights grounded in the narratives of local stakeholders and conceptualised from a wider, social practices perspective will help guide the design of policies and programs in a way that breaks through structural barriers and encourages innovation in practice. Feedback provided with respect to our research methodology will inform future research in this field.

Acknowledgements

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