

AN INVESTIGATION OF THE PERCEIVED CONSEQUENCES TO EMPLOYEES OF REDUCING EMPLOYMENT RELATED TRIP END CHOICES IN CAPE TOWN

H MOYO and R DEL MISTRO*

Centre for Transport Studies, Department of Civil Engineering, University of Cape Town,
Private Bag X3, Rondebosch, 7701; Tel: 021-650 2605;
Email: tmkhaz001@myuct.ac.za /*Email: Romano.DelMistro@uct.ac.za

ABSTRACT

In South Africa, the bench mark for transport expenditure is 10% of monthly income. In the global South “transport poverty” is not a foreign concept considering that most individuals use more than 10% of their income on transport. The driver of these high transport costs is the positioning of economic activities relative to residential areas. Additionally, concerns over Peak Oil and its impact on fuel price means transport will become even more unaffordable in the future. Using Cape Town as a study area, this paper explores the concept of “too much” choice in a job choice framework to investigate the hypothesis that, the provision of a large catchment area from which individuals seek jobs does not continue to yield an increase in utility, but that there is a point beyond which benefits from having more choice are negligible. The results suggest that in a job choice framework, an increase in catchment size does not result in an increase in utility, instead as the catchment size increases utility decreases. It is therefore concluded that there is an amount of accessibility that cities can provide that can be considered to be “sufficient” and still enable individuals to attain positive utility. From the findings in this study, providing “sufficient” accessibility can be achieved by locating future urban growth thereby reducing home to work distances which may translate to a reduction in transport costs.

Keywords: “too much” choice; city restructuring; utility; catchment size; transport costs.

1. INTRODUCTION

Traditional theories on urban form posit that employment is concentrated in the central business district (CBD) and that individuals make a trade-off between cheaper housing and transport costs (Alonso, 1964). With the exponential growth of cities and urban sprawl, distances to the CBD have increased and consequently impacted on commuting to work for most individuals. Increase in fuel prices which translates to an increase in transport costs has made peripheral home locations unattractive as transport has become unaffordable for this cohort of individuals.

South Africa is one of the many examples where marginalised groups have limited access to affordable transport and how this has marginalised already poor groups from participating in productive economic activities. One interesting observation made from the National Household Travel Survey, (DOT, 2003) was that most people in the low and lower middle income group were spending more than 20% of their income on transport costs. This is above the national bench mark pegged at 10% of income (Behrens, 2005).

This study is motivated by the precariousness of transport costs for marginalised groups and how they are exacerbated by long commuting distances between places of residence and work locations. By exploring choice within a job choice framework and determining whether the provision of a larger employment opportunity pool provides any additional benefits, this paper investigates how much accessibility cities should provide. Findings from a study of the low income group in Cape Town are reported. These individuals were identified to be living in “transport poverty”.

The next section provides a literature review that delves into understanding the concept of choice. Section 3 briefly introduces the modelling procedures and how they were applied to this study. In section 4, the findings are presented and discussed within a Cape Town context. Section 5 concludes by discussing the applicability of these findings within global South cities especially in an environment where there is an expected upward trajectory in city sizes and population.

2. LITERATURE REVIEW

One of the fundamental aspects used in this study is to understand the value of choice to individuals and how this could be transposed onto a job choice framework. Due to the unavailability of literature on “sufficient accessibility” this paper was forced to use notions of choice from psychology to put into perspective the value of choice. The following questions guided in trying to apply the notion of choice to a job choice framework.

1. What are the benefits and cost of increased choice? In the fielding of marketing and psychology choice has been observed to reach a point where it is optimal thereafter there are no benefits to be derived (Schwartz, 2004, Markus & Schwartz, 2010). From reviewing studies relating to choice, three fundamental aspects were identified on the response of utility to changes in choice:

- in small quantities choice is *beneficial*
- as the number of options increases, the *benefits increase at a decreasing rate*
- as the number of options increases, utility reaches a *maximum* and thereafter results in *negative effects*

2. Is it feasible to employ city restructuring as a solution to affordable transport? City restructuring in this case would entail small cities (sub-cities) which have “radii” that provide “sufficient” internal accessibility and limited external mobility. In a job search framework, city restructuring might appear draconian in that, it could make it difficult to access other employment nodes. Essentially, this may result in positive and negative effects as it limits the amount of opportunities available to individuals. This may be a starting point in determining the size of the sub-cities that will encourage public and non-motorised transport and at the same time ensuring “sufficient” accessibility.

The three fundamental aspects on the responsiveness of utility to choice form the basis of trying to transpose the “too much” choice concept onto a job choice framework. This study tries to show the “too much” choice effect within the job search/choice to establish the amount of accessibility that cities should provide. The argument is that if cities provide “sufficient” access to job opportunities (hence choices) within a given catchment area, there is room to reduce work commutes and this could be transferred to savings in transport costs.

A review of the job-housing nexus aided in understanding whether residential decisions impact the journey to work. Timmermans (2003) argued that one attribute that has precipitated job-housing mismatches is the lack of options for unemployed people. He points out that the spatial allocation of land-uses make people travel. On the other hand, Weitz (2003) explained that if the supply of housing and job creation within a certain area are not matched, it results in an increase in the number of people who work in a new area but live somewhere else and few who live and work in that new area. In a Cape Town setting, the CBD, southern and northern suburbs have all the economic dominance. These areas are far from where low-wage workforce live (Turok, 2001; Sinclair-Smith & Turok, 2012). This has exacerbated the spatial mismatch between jobs and housing thus making the marginalised groups economically excluded. The poor are the most vulnerable to the consequences of high fuel prices as a result of peak oil and yet they have limited options in terms of travel and mode choice. Furthermore, their ability to change their work locations is limited (Del Mistro, 2010). This shows urgency in implementing interventions that aim at finding solutions to affordable transport for the urban poor.

One of the consequences of job-housing mismatches is referred to in the literature as excess commuting. Concisely put, excess commuting represents the difference between actual travel and the travel that would be required by individuals to travel to their closest possible work place (Ma & Banister, 2006). In Cape Town, the poor cannot relocate closer to the CBD as housing is unaffordable. Given that, they make a trade off between cheaper housing and transport costs thus resulting in them living farther from employment rich areas. Tabane (2005) measured excess commuting in Cape Town and found that excess travel among the affluent is 16% and 6% for the marginalised groups. From a transport affordability perspective, in Cape Town, solutions that address excess commuting are unlikely to result in significant benefits given the low percentages of the phenomena. As such a proactive approach needs to be taken to ensure that work travel is affordable for marginalised groups; one such strategy is city restructuring through strategically guiding the growth of cities.

3. METHOD

Cape Town was used as a study area. The study focused on the low and lower middle income groups as they were identified to be spending more than 10% of their income on transport. However, this paper only discusses the findings from the low income respondents; these are public transport users and were found to have longer commuting distances compared to the lower middle income.

Two hundred (n=200) low income respondents earning between R3000-R6000 in 2013 prices were recruited using AMPS (All Media Products Survey) suburb listing. This sample size satisfies the requirement of fifty respondents for each choice profile (Hensher et al., 2005). A limit of 10 interviews per sampling “point” was used and every eighth house was selected. Only one member per household was interviewed. Focus group discussions and a stated preference survey were used for this study.

3.1 Designing the Stated Preference Survey.

3.1.1. Choosing Appropriate Attributes for the Study

It was important to identify the variables individuals considered when looking for a job. Twenty attributes which influenced job choices were identified in the literature (Kolstad, 2011; Chimanikire, et al., 2007; Tversky, 1972). Focus group discussions were used to reduce the list until only attributes that resonate with the group of interest remained. The final list of attributes that came out of the focus group comprised of five attributes, *travel time, distance from home, cost of transport, changes in salary and the number of job opportunities in an area*. These were identified as the important variables that individuals considered when choosing a job and its location. Participants were also asked to suggest possible levels (values) for the attributes. Inherent in the analytical method is the need for variability in the value of each attribute. As such each attribute has more than one value, as indicated below.

3.1.2 Defining the attributes and their levels

Distance between home and work is a key attribute and six levels were used in the study i.e., 5, 10, 15, 20, 25 and 30 km. These distances were chosen based on the commuting distances commuted by the low income individuals in Cape Town; the focus group was used to verify the distances.

Travel time describes a one way peak period travel time for each commuting distance. Peak period travel times were chosen as this is when people make their journey to/or from work. Travel time is analysed at 2 levels for each of the distances.

Cost of Transport is defined as the monthly expenditure dedicated to transport. Data from the Metrorail, Golden Arrow and the City of Cape Town were used to identify the cost per trip for each of the public transport modes. The average one way trip for the three modes was used to calculate the cost of transport. Twenty-two working days were assumed to estimate the monthly expenditure on transport..

Change in Salary is the additional salary that would make individuals start considering taking a new job. Focus group participants were asked to identify a percentage increase in salary. A 15% increase was identified as a reasonable increase. Change in salary is analysed at 3 levels.

Number of Job Opportunities Advertised is identified as the number of job vacancies that open up each month per commuting distance. To find the number of jobs available within each distance per month, the work trips per commuting distance (Del Mistro & Maunganidze 2012) were used as a proxy for the number of workers in each of the commuting distances. Worker turnover rates (Proctor & Del Mistro, 2013), were multiplied with the number of workers to calculate the number of jobs advertised per month for each commuting distance.

Table 1 provides a list of attributes used and their calculated levels

Table 1: A list of attributes and value of the levels

Distance from Home	code	5	10	15	20	25	30
Travel Time	1	15	25	40	50	65	75
	0	10	20	25	35	40	50
Cost Of Transport	1	300	400	750	680	840	1350
	0	200	260	500	460	560	900
Change In Salary	0	1000	1000	1000	1000	1000	1000
	1	900	900	900	900	900	900
	2	700	700	700	700	700	700
Number Of Jobs Advertised	1	8	17	27	33	31	38
	0	7	15	22	27	37	32

3.2 Experimental design

To test all the combinations of these attributes would require 144 profiles (i.e. $6 \times 2 \times 2 \times 3 \times 2$). Since a single respondent would be unable to consider all 144 combinations, a fractional factorial design consisting of 18 experiments was developed using R studio version 2.11.1 (R Studio Inc 2012). This was blocked into 2 blocks of 9 pairs (Street, et al., 2005). This means that each respondent faced 9 choice sets.

3.3 Survey Design and Administration

The questionnaire had an introductory section which asked respondents to describe their current travel patterns. Section 2 was a typical Discrete Choice Experiment (DCE) stated preference exercise which asked individuals to make a choice between two scenarios and their status quo. In Section 3, respondents were asked to rank the variables using a 4 point importance scale. Section 4 aimed at identifying respondents' preferred work location, this aided in comparing what individuals thought were a reasonable commuting costs, time and distance. Respondents' socio-demographic information was collected in Section 5. The questionnaire tested well in the pilot. Figure 1 provides a sample of the DCE choice pair.

Q1a) Which of the following 2 options would you prefer?

Scenario 1		Scenario 2	
Factors to consider	30 Kilometres from Home	5 Kilometres from Home	
Travel time	50 Minutes	10 Minutes	
Cost of Transport	950 Rand Per Month	220 Rand Per Month	
Change in Salary	500 Rand per Month	1000 Rand per Month	
Number of Jobs Advertised	32 Per Month	8 Per Month	

Please tick the scenario you prefer: Scenario 1 OR Scenario 2

b) Given the above options, would you rather stay in your current situation? YES OR NO

Figure 1: An example of the Stated Preference Choice Pair

In the example given in fig 1, question (a) represents the “forced” choice in which respondents would choose either Scenario 1 or Scenario 2, described by the attributes of two job locations. Question (b) represents the “unforced choice” giving a respondent the opportunity to opt out of the chosen scenario. This would imply that the current situation is much better than any of the suggested options.

4. RESULTS AND DISCUSSION

The response rate for the survey was 81.8%. Fifty six percent of the respondents were found to travel less that 30 minutes one way to work. Forty eight percent of the respondents travelled more than 15km one way to work. It was also found that 36.5% of the respondents spent more than 10% of their income on transport which is above the national benchmark. The median age ranged between 36-44. The results on the semi-structured questions showed that distance from home was the most important attribute; number of jobs advertised was considered as not important by most respondents.

4.1 Comparison of the preferred and current situation

It was important to evaluate whether a change in working location would result in a reduction in transport costs. Given that, respondents were asked to indicate a location they had previously considered as preferable in their job search. The aim was to try and identify the difference in transport costs between the two scenarios and evaluate whether the preferred location would result in most respondents incurring transport costs within the 10% benchmark. Respondents indicated that their chosen preferred location would allow them to either walk to work or commute a shorter distance. Figure 2 shows a graphical representation of the comparison of commuting costs between the current and the preferred location.

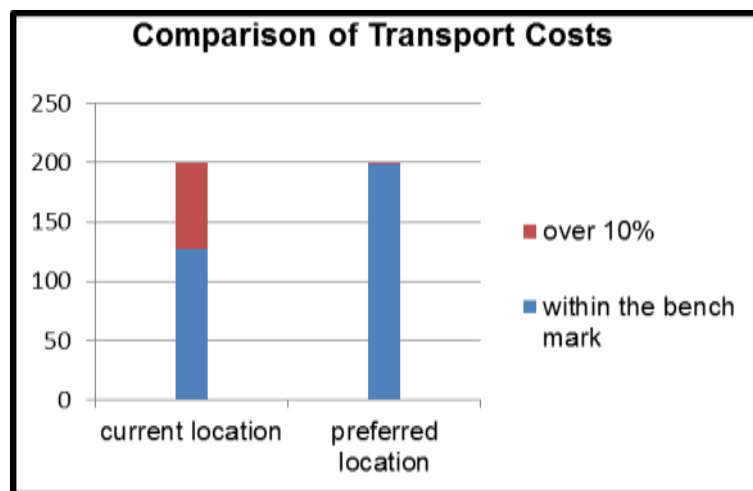


Figure 2: A comparison of transport cost for the current situation and preferred location

The results on the comparison of transport costs show a remarkable difference in transport expenditure between the current and the preferred work location. Almost all individuals spend within the 10% bench mark on transport costs in the preferred work location. This is an encouraging observation especially in an atmosphere where a reduction in transport costs is a fundamental issue. What the finding suggests is that commuters prefer a shorter commute to work; and what is needed is to come up with strategies that allow for these potential benefits to be exploited.

4.2 Model Specification and Estimation

The choice experiment structure is estimated using a random utility model based on McFadden (1974). The basic premise is that individuals seek to maximise their utility and therefore choose a scenario that provides the greatest utility. The decision making utility equation for this study is of the form given in (1);

$$U_{ni} = \alpha_1 + \beta_1 X_{1ni} + \beta_2 X_{2ni} + \dots + \beta_m X_{mni} + \varepsilon_{ni} \quad (1)$$

where the β s represent the part worth utility of each attribute and X represents the value of each individual attribute. A multinomial logit is estimated for the DCE responses using the econometric package LIMDEP 7 NLOGIT.

To ensure that variables were not included randomly into the models, a priori expectations, economic theory and the level of significance were used to inform on the variables to include (i.e. a logical sign and p-value <0.05). The acceptable adjusted rho squared for this type of analysis lies between 0.2-0.4 (Hensher et al., 2005).

Eighteen different models were estimated before a model that better represented the respondents' preferences was identified. These included the "forced" and "unforced" choice cases. The first model (Model 1) estimated in both cases included all variables that were considered for the study. The number of jobs advertised in the "forced" choice and distance in the "unforced" choice case were not statistically significant.

One of the fundamental aspects for this paper is to analyse the impact of individual distances on utility. This prompted dummy variables to be introduced; these were created for each of the commuting distances. Each commuting distance represented a catchment size. From here on, catchment size and distance are used interchangeably with,

- Catchment 1 is less than or equal to 5 km (DIST1)
- Catchment 2 is less than or equal to 10km (DIST2)
- Catchment 3 is less than or equal to 15km (DIST3)
- Catchment 4 is less than or equal to 20km (DIST4)
- Catchment 5 is less than or equal to 25km (DIST5)
- Catchment 6 is less than or equal to 30km. (DIST6)

A second model (Model 2), for the "forced" choice case was estimated. It was observed that distances greater or equal to 25km provided the same impact on utility; these were combined by creating a dummy variable called DIST5a. This combination was used for all subsequent "forced choice" models. In estimating the "unforced" choice models, an alternative specific constant (ASC) was introduced to capture the status quo effect. This is used to measure the inertia to move or utility associated with staying in the current situation (Adamowicz et al., 1998). A negative and significant coefficient of the ASC shows the utility associated with moving away from the current situation and a positive and significant ASC represents the utility associated with staying in the current situation.

Coefficients estimated for six selected models are presented in Table 2.

Table 2: Results from selected estimated models for the “forced” and “unforced “choice cases.

	Forced choice Case						Unforced choice case					
	Model 1		Model 2		Model 6		Model 1		Model 8		Model 12	
Log likelihood Base model	-1247.66		-1247.66		-1247.66		-1974.21		-1974.21		-1974.21	
Log likelihood Choice model	-819.21		-811.25		-811.87		-1610.61		-1579.10		-1579.90	
Rho-squared	0.34		0.35		0.35		0.18		0.20		0.20	
No of Observations	3600		3600		3600		5400		5400		5400	
Attributes	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value
Distance	-0.087	0.000					-0.005	0.398				
Travel Time	-0.014	0.026	-0.021	0.004	-0.023	0.000	-0.008	0.004	-0.003	0.212		
Cost of transport	-0.001	0.000	-0.001	0.020	-0.001	0.001	-0.001	0.000	-0.001	0.000	-0.001	0.000
Change in salary	0.001	0.000	0.002	0.000	0.002	0.000	0.000	0.026	0.000	0.758		
Number of jobs Advertised	0.012	0.327	0.015	0.354			-0.028	0.000	-0.013	0.031	-0.013	0.016
DIST1			2.113	0.001	1.528	0.000			4.221	*	4.400	*
DIST2			2.013	0.000	1.561	0.000			-0.291	0.003	-0.301	0.002
DIST3			1.343	0.002	0.939	0.000			-0.431	0.000	-0.444	0.000
DIST4			1.211	0.000	1.007	0.000			-0.449	0.001	-0.495	0.000
DIST5			0.125	0.449					-1.204	0.000	-1.254	0.000
DIST6			-5.805	*					-0.847	0.000	-0.906	0.000
DIST5a					-4.034	*						
ASC									0.351	0.083	0.274	0.006

DIST 5a represents all distances >25km

*represents the p-values for the omitted dummy variable with the β calculated using $1-\sum\beta_{1 \rightarrow N}$

Using the previously mentioned criteria on the suitability of variables and the general performance of models as determined by the rho squared, Models 6 and 12 were found to better represent (“best fit”) the preference of the respondents.

While the next section provides a complete discussion of the findings from Model 6, findings from Model 12 are discussed in passing for completeness of the study.

4.2.1 Discussion of results and their applicability to the Cape Town context.

In Model 6, all attributes had the expected signs and were statistically significant. The coefficients (part worth utility) for DIST1 (distance of 5km) to DIST4 (distance of 20km) are positive. This implies that respondents positively value short commuting distances. This is consistent with qualitative results from the focus groups where respondents indicated that shorter commutes would allow them to save on time and money. There is a significant decrease in the part worth utility from 0.939 to -4.034 between DIST3 and DIST5a, i.e. between 15km and 30km. What this finding suggests is that if a 40km commuting distance was included in the model this would result in an even lower part worth utility compared to 30km. (A similar relationship between distance and utility can be seen in the coefficients of Model 12).

4.2.2 Impact of catchment distance (and therefore size) on utility

This section seeks to establish the responsiveness of utility to a change in catchment size (commuting distance). This helps in evaluating the utility that accrues to individuals as the catchment size increases. By finding and defining the linkage between catchment size and utility, characteristics that are observable within the “too much” choice theory can be identified and this aids in addressing the objective of this paper. Figure 3 shows the relationship between utility and catchment size.

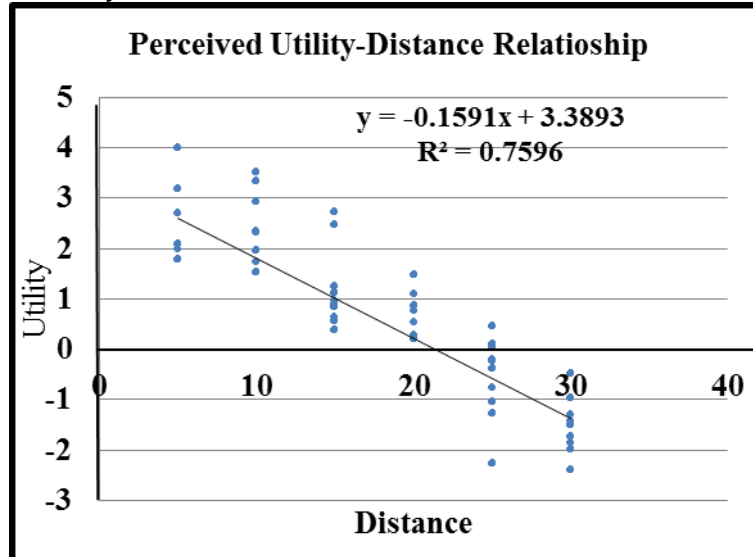


Figure 2: Impact of commuting distance on Utility

Figure 3 suggests that there is a consistent downward trend in the amount of utility yielded as the catchment size increases. It is observed that there is a negative impact on utility to respondents when distance is greater than 20 km. In a Cape Town context where political history has influenced residential planning, marginalised groups are in the peripheries, long commutes are inevitable. Nevertheless, with the increase in population and size of the developing cities; this is an opportunity for policy to put in place strategies that locate this growth so that commuting distances do not increase but potentially decrease; i.e. a better balance between housing and jobs.

5. CONCLUSIONS: TOWARDS POLICY AND ACCESSIBILITY TO JOBS

The aim of this paper was to investigate the hypothesis that, the provision of increasing choice to individuals within a job choice framework does not continue to yield positive utility, instead there is a point where choice is regarded as “sufficient” and beyond that, there are costs associated with more choice. By investigating this hypothesis, this may be a starting point in addressing the question on what amount of accessibility should cities provide. In this discussion, a large catchment size represented a larger number of job opportunities advertised per month. However, a decrease in utility was observed with an increase in distance or catchment size. This shows that more choice does not necessarily result in an increase in utility or benefits.

The discussion on Cape Town data showed that longer commutes were accompanied by negative part worth utilities. In this context, what this finding suggests is that there are no benefits to respondents to commute distances greater than 20km. It can be construed that there are significant successes that can be achieved if policy intervenes through strategies that may reduce work related commuting distances.

The proposed city restructuring strategy may be an applicable solution to reduce work related commuting distances which may translate to savings in transport costs. The current study showed that utility for respondents decreases as the catchment size increases. Catchment 1 and 2 which correspond to a distance of 5km and 10km were identified to result in the highest positive part worth contribution to utility compared to any other commuting distance. As mentioned earlier developing world cities are expected to grow in size, this will compound longer commuting distances which translate to higher transport costs. This means that unless interventions that locate the new growth to ensure there is a reduction in distance between home and work locations are implemented, commuting distances will be even longer. This study raises the possibility that city restructuring can be a solution; however, more research needs to be carried out to identify the sizes of the sub-cities that will provide “sufficient” accessibility. One conclusion that can be made based on these findings is that a city size with a 25km radius may not be an appropriate size as it has been observed to result in negative utility.

One outcome that is clear from this study is that monetary costs incurred in commuting are clear to individuals, but when we begin to discuss utility, there is more than just the monetary expenditures and this is a very important aspect. It is appreciated that cities are self organising entities and they attempt to meet demand, which is predominately driven by market forces of natural growth, which include individual choices of where to work or stay. In developing country environments where the public transport system is subsidised, a business as usual approach where individuals continue to commute long distances (by making rent and transport costs trade-offs) will continue to impose social costs on society resources that could otherwise be invested in other lucrative endeavours. Individuals lobby for subsidies on transport by arguing that transport costs are high as a result of long commutes. These long commutes are shaped by the choices individuals make in their house and job searches and the amount of accessibility provided by cities.

In that regard, it is important to accept the role that individual choices play in influencing spatial locations and find ways to account for these in policy by acknowledging the role of accessibility in shaping the city. From a policy perspective, land-use transport integration can be implemented in such a way that it allows for cohesion between housing and job availability. There are no restrictions within cities on where individuals can look for work. For some cities of the South, the transport systems provide great accessibility and mobility and this creates the impression that the current trip end choices are beneficial. This has been shown to not be the case in this study. In that regard, policy may play a role of educating and alerting individuals to their spatial choices on housing and jobs and how they influence their commuting patterns hence transport expenditure. However, this is only applicable in cases where historical inheritance –such as apartheid- has not positioned residential locations such that they are in the peripheries which make shorter commutes difficult.

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