Water, Mobility, and More: Insights into Italian Youth's Willingness to Adopt Sustainable Behaviors

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Research Questions

1. How much do Italian adolescents consider important to decrease the consumption of meat, water, and fast-fashion clothes?
2. How much do Italian adolescents consider important to increase the usage of public and private ecological transportation?
3. Are they more sensitive to Socio/Environmental arguments or Individual/Economic ones?
4. Does this sensitiveness change depending on specific individual attitudes?

Motivations

- Adolescents are the future assets of the nation and will be the policy makers governing sustainable environmental practices. Adolescence is a critical period for behavior change, particularly in relation to pro-environmental behavior (Palupi and Sawitri 2018).

- Adolescents' biospheric values and environmental self-identity were associated, via personal norms, with a wide range of pro-environmental behaviors, including recycling, environmentally friendly traveling, purchasing environmentally friendly goods and drinking tap water (Balundė, Perlaviciute, and Truskauskaitė-Kunevičienė 2020).

- Pro-environmental intentions among adolescents are fonud to be significantly influenced by the adolescents' awareness (Basri, Abdul Sukor, and Hassan 2015): interventions seem to be effective only among those who were ready to start saving behaviors (Bell et al. 2016).

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Overview of the Study

- The data come from a survey conducted in Italian high schools in the period mid-March 2022 to mid-April 2022.

- The experiment is conducted within the scope of a collaboration between the University of Siena and the no-profit foundation Fondazione Mondo Digitale (FMD), and it was approved by the Ethical Committee of the University of Siena (CAREUS).

- The survey was implemented online with the platform Qualtrics. The link was then distributed to the schools that were in contact with FMD. In this sense, we can safely assume that, although schools self-selected to participate in the project, the individual students did not strongly self-select with regards to answering the survey.

- The survey is implemented in a way such that every individual is randomly assigned to one of the treatments (or control group).

The Dataset

The sample is composed by 829 students enrolled in the Italian Secondary Education System. About them we know:

- *Gender:* Males (53.8%); Females (41.9%); Others (4.3%).
- *Age:* 13-16 y.o. (12.3%); 17-20 y.o. (87.7%)
- *Macro Region:* North (39%); Centre-South (61%).
- *Parental Education:* At least one HE (32.8%); At least one SE (42.1%); Others (25.1%).
- *Headache:* 'I'd wait for it to pass' (56.2%); 'I'd take a drug' (37.2%); 'I'd take a natural remedy' (6.6%).

A focus on the Headache variable

- *Self-Medication Hypothesis (Hong et al. 2019):* People (especially adolescents) with a greater tendency in internalizing problems is highly associated with the usage of medicines without prescription;
- Among adolescents, self-medication is associated with higher level of psychological distress in the transition toward adulthood (Damphousse and Kaplan 1998).
- Regarding natural remedies, among adolescents an emotional affinity for nature is found to be a mediator factor for pro-environmental attitudes (Krettenauer 2017).

PRINCALS (Gifi 1990): This approach aims to minimize a loss function, which evaluates the goodness of fit (distance) between the quantifications of item categories and one or more latent variables (dimensions that are not directly observable) that represent the concept of interest. It is very useful for analyzing survey data with ordinal categorical items (Carpita 2003).

PRINCALS - Loadings					
Series	Question	Comp.1	Comp.2	Comp.3	Comp.4
Attention	Physical Health	-0.721	-0.348		
Attention	Mental Health	-0.666	-0.466	-0.186	
Attention	General Wellbeing	-0.709	-0.508	-0.124	
Importance	Balanced Nutrition	0.393	-0.668	-0.244	-0.364
Importance	Prevention and Control	0.195	-0.445	0.730	0.187
Importance	Sleeping	-0.303	0.492	-0.558	-0.463
Importance	Attention to drugs	-0.313	0.185	0.626	-0.432
Importance	Social Relationships	-0.389	0.558		0.638
Importance	Physical Activities	0.454	-0.332	-0.481	0.408

Importance (Variance Accounted For):				
	Comp.1	Comp.2	Comp.3	Comp.4
Eigenvalues	2.2051	1.9377	1.5765	1.1525
VAF	24.5008	21.5302	17.5170	12.8052
Cumulative VAF	24.5000	46.0300	63.5500	76.3500

- **Comp.1 - Easygoing:** emphasizes the person's scarce attention toward health, while giving importance to relax and social relationships.
- **Comp.2 - Nutrition Enthusiasm:** emphasizes the person's prioritization about maintaining a healthy and balanced diet to optimize their overall well-being.
- **Comp.3 - Fitness Dedication:** emphasizes the person's dedication to exercise and physical fitness, and suggests that they may prioritize this aspect of their health over other areas.
- **Comp.4 - Health Reliance:** emphasizes the person's reliance on health-related practices, such as medicine or therapy, to maintain their well-being.

The treatment consists in showing every subject a brief text. Each subject is randomly assigned to one of the following treatments. People in the control group have received no text.

Meat consumption

- *Social/Environmental Argument:* The beef is the most polluting of all protein sources in terms of carbon dioxide production.
- *Individual/Economic Argument:* The consumption of processed meat is associated with an increased risk of colorectal cancer and type 2 diabetes.

Water consumption

- *Social/Environmental Argument:* By 2050, more than 5 billion people will live with water scarcity for at least one month per year.
- *Individual/Economic Argument:* The hyper-saline sludge generated by water desalination plants has extremely expensive disposal processes.
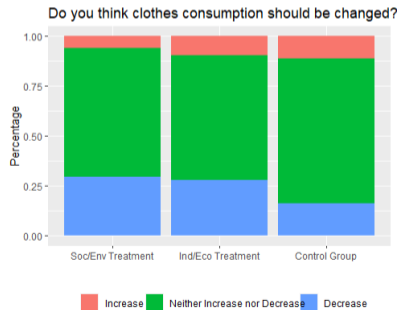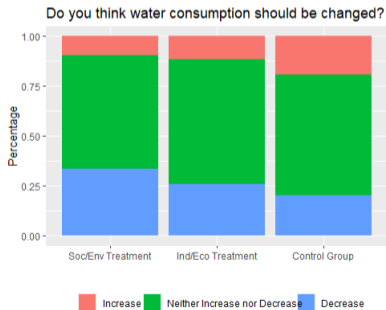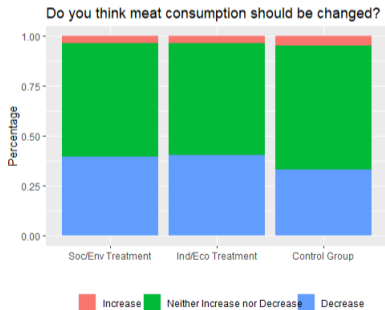
Clothing consumption

- *Social/Environmental Argument:* Every year, 35kg of textile waste is produced per consumer, which is 400% more than 20 years ago.
- *Individual/Economic Argument:* A fast fashion garment is not made to be worn more than ten times due to poor materials, fueling the need to continually buy new clothes.

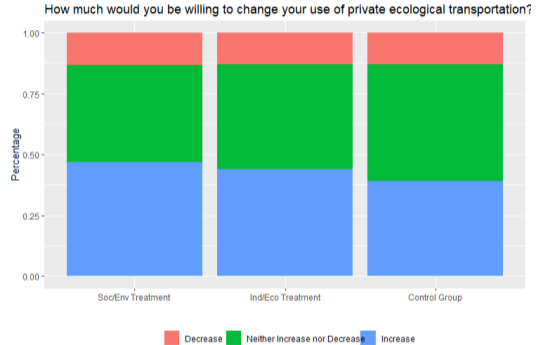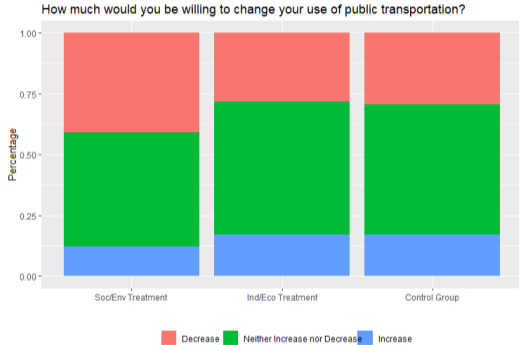**Public and Private Ecological Transportation**

- *Social/Environmental Argument:* More than 3.53 billion hours per year are needed to reach the workplace: this will result in the production of carbon dioxide levels of up to 214 million tons per year by 2030.
- *Individual/Economic Argument:* The percentage of young people aged 5-15 who go to school by bike or on foot has decreased from 48% in 1969 to 16%, and this is associated with an increase in youth obesity.

Dependent Variables 1/2

For each item, a question was asked using a 6-level Likert scale, which was later reclassified into a 3-level categorical variable. The question aimed to investigate students' opinions about the need to adopt more pro-environmental behaviors.

Dependent Variables 2/2

How much would you be willing to change your use of public transportation?

How much would you be willing to change your use of private ecological transportation?

Decrease   Neither Increase nor Decrease   Increase

In this case, the analysis will control also for the distance between home and school, which will be categorized as follows: less than 1 km (19.06%), between 1 and 5 km (46.08%), and more than 5 km (34.86%).

Ordered Multinomial Logit

- In this exploratory analysis, all the covariates mentioned above are used to estimate an Ordered Multinomial Logit model for each of the three dependent variables.

- Each dependent variable among Meat, Water, and Clothing is classified into three levels: *i)* Increase = 0 (I); *ii)* Neither Increase nor Decrease = 1 (NInD); *iii)* Decrease = 2 (D).

- Dependent variables about mobility are categorized in the opposite direction: *i)* Decrease = 0 (D); *ii)* Neither Increase nor Decrease = 1 (NInD); *iii)* Increase = 2 (I).

- Following the main analysis, predicted probability plots will be generated to explore the interaction between treatments and statistically significant principal components, with the goal of identifying specific arguments that could be targeted towards particular groups of people.

- The parallel lines assumption for all the estimated models was tested using a Brant Test, and it was found to hold for each regression.

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Explorative Analysis 1/2

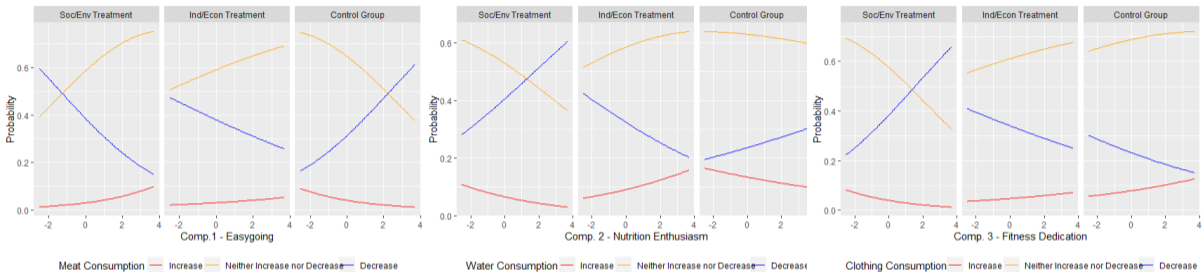|	Ordered Multinomial Logit					
Dependent Variable	Meat Consumption		Water Consumption		Clothes Consumption	
Independent Variable	$\hat{\beta}$	$\hat{\sigma}$	$\hat{\beta}$	$\hat{\sigma}$	$\hat{\beta}$	$\hat{\sigma}$
Gender (Ref: Males)						
Females	1.011**	0.167	0.235	0.164	0.089	0.171
Others	0.815***	0.369	0.790**	0.358	-0.009	0.394
Age (Ref: 13-16 y.o.)						
17-20 y.o.	-0.072	0.219	0.090	0.208	0.035	0.220
Macro-Region (Ref: North)						
Centre-South	-0.317*	0.163	-0.298*	0.162	-0.537***	0.170
Parental Education (Ref: At Least One HE)						
At Least One SE	-0.174	0.168	-0.216	0.163	-0.055	0.171
Other	-0.235	0.192	-0.191	0.186	-0.219	0.196
Headache (Ref: "I'd wait for it to pass")						
"I'd take a drug"	-0.006	0.153	-0.488***	0.149	-0.212	0.156
"I'd take a natural remedy"	0.207	0.293	-0.267	0.295	-0.075	0.301
Principal Components						
Comp.1 - Easygoing	-0.070	0.076	0.041	0.071	0.065	0.076
Comp.2 - Nutrition Enthusiasm	0.156**	0.074	0.052	0.070	0.218***	0.074
Comp.3 - Fitness Dedication	0.010	0.072	-0.085	0.069	0.018	0.074
Comp.4 - Health Reliance	0.038	0.072	-0.031	0.070	-0.029	0.074
Treatment (Ref: Control Group)						
Soc/Env Treatment	0.326*	0.018	0.771***	0.175	0.719***	0.186
Ind/Eco Treatment	0.299*	0.176	0.433**	0.171	0.542***	0.182
$Intercept_{I|NInD}$	-3.067***	0.327	-1.851***	0.293	-2.416***	0.305
$Intercept_{NInD|D}$	0.827***	0.287	1.164***	0.287	1.192***	0.292
No. Observations			829			

- Strong gender differences emerge specifically in relation to the question about meat consumption, while students from the Centre-South region consistently display less propensity to adopt pro-environmental behaviors.

- Only the second component, which is mostly associated with attention towards balanced nutrition, shows a significant association with two out of three environmental behaviors.

- Across all three regression analyses, the treatments show a positive association with the dependent variable, particularly the Socio-Environmental component.

Explorative Analysis 2/2

Ordered Multinomial Logit				
Dependent Variable	Public Transport		Private Eco-Transport	
Independent Variable	$\hat{\beta}$	$\hat{\sigma}$	$\hat{\beta}$	$\hat{\sigma}$
Distance from School (Ref: More than 5 kms)				
Between 1 and 5 kms	-0.099	0.153	-0.139	0.152
Less than 1 km	-0.077	0.186	-0.395**	0.186
Gender (Ref: Males)				
Females	0.048	0.156	0.191	0.155
Others	0.653*	0.354	0.388	0.351
Age (Ref: 13-16 y.o.)				
17-20 y.o.	0.196	0.207	0.347*	0.206
Macro-Region (Ref: North)				
Centre-South	-0.057	0.156	0.168	0.155
Parental Education (Ref: At Least One HE)				
At Least One SE	-0.506***	0.159	0.155	0.156
Other	-0.605***	0.180	-0.087	0.175
Headache (Ref: "I'd wait for it to pass")				
"I'd take a drug"	-0.144	0.142	-0.115	0.141
"I'd take a natural remedy"	-0.335	0.283	-0.209	0.275
Principal Components				
Comp.1 - Easygoing	0.078	0.070	-0.015	0.069
Comp.2 - Nutrition Enthusiasm	-0.160**	0.068	-0.094	0.067
Comp.3 - Fitness Dedication	-0.056	0.067	0.053	0.066
Comp.4 - Health Reliance	-0.024	0.067	0.051	0.066
Treatment (Ref: Control Group)				
Soc/Env Treatment	-0.459***	0.166	0.205	0.164
Ind/Eco Treatment	0.025	0.162	0.130	0.161
$Intercept_{I|NInD}$	-1.195***	0.279	-1.448***	0.276
$Intercept_{NInD|D}$	1.305***	0.280	0.757***	0.271
No. Observations	829			

- Students from highly educated families tend to be more willing to increase their use of public transport, whereas nutrition enthusiasts may be less interested in this pro-environmental behavior.

- The socio-environmental argument has a significant negative impact on pro-environmental attitudes in relation to public transport.

- The use of private ecological transportation is negatively associated only with short distances between home and school, while it is positively associated with age.

- Our hypothesis is that younger individuals may have a lower level of interest in private ecological transportation, despite recognizing the importance of increasing its usage.
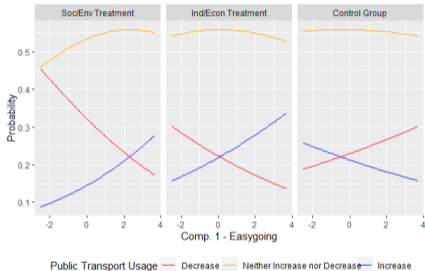
- As the first component increases, the treatments appear to have a negative effect on willingness to reduce meat consumption. Nevertheless, the availability to reduce meat consumption is always higher than the availability to increase it.

- As the second component increases, the Ind/Econ Treatment appears to have a negative effect on willingness to reduce water consumption. Nevertheless, the availability to reduce water consumption is always higher than the availability to increase it.

- As the third component increases, the Ind/Econ Treatment appear to have a negative effect on willingness to reduce clothes consumption. Nevertheless, the availability to reduce clothes consumption is always higher than the availability to increase it.

Models with interactions 2/2

Public Transport Usage — Decrease — Neither Increase nor Decrease — Increase

Private Eco-Transport Usage — Decrease — Neither Increase nor Decrease — Increase

- As the first component increases, the treatments appear to have a positive effect on willingness to increase the use of public transport. Nevertheless, in general they are not willing to change their behavior in any direction.
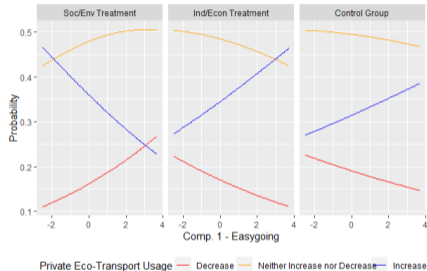
- In this case, we observe a very weak negative association between the Soc/Enc Treatment and the first component. This confirms that individual arguments are more effective than socio-environmental arguments for promoting pro-environmental behaviors related to mobility.

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Conclusions

- Based on the interviews conducted, a majority of students appear to believe that there is no need to alter their consumption behaviors with regards to meat, water, clothing, and public transport. At the same time they are favourable with an increase in the use of private ecological transportation.

- However, individuals who received one of the treatments are more inclined to express the view that pro-environmental behaviors should be increased, particularly those who received the socio-environmental treatment.

- The only exception pertains to the analysis of mobility, where the socio-environmental argument seems to be counterproductive in promoting pro-environmental behaviors.

- The fact that in some cases a negative conditional treatment effect emerge could be a useful starting point for further research.

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