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The Effect of COVID-19 on the Environmental Impact of Our Lifestyles and on Environmental Concern

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Abstract: Since the beginning of 2020, the worldwide COVID-19 pandemic made it necessary to change our lifestyles (e.g., restrictions on transport or travelling and forced telework). This has also changed the environmental impact of our lifestyles. To quantify that impact, we used surveys to calculate the Ecological Footprint (EF) and environmental concern of Belgian respondents in 2021 and compared this to the EF-situation in 2017, before COVID-19. We observed that the EF became significantly lower during the COVID-19 crisis. Of course, this change in behaviour is the result of compulsory measures. Therefore, we asked about people's willingness to reduce the EF permanently, particularly after COVID-19 and on a voluntary basis. We observed that, in 2021, respondents had a strong desire to return to a pre-COVID-19 lifestyle and that they are even less concerned about the environment than they were in the period before COVID-19. Moreover, these results hold after taking into account the effect of different explanatory variables in a multivariate analysis. As a general conclusion, there is little or no evidence that COVID-19 will fundamentally change the environmental impact of our behaviour or our environmental concern if there is no associated public intervention. There is a need for policies that make use of the potential created by COVID-19 (e.g., stimulate working from home and increased cycling).

Keywords: environmental impact; ecological footprint; effect of COVID-19

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1. Introduction

Over the past few decades, it became increasingly clear that environmental and climate challenges are there to be taken very seriously. All of us have witnessed or have been the victim of severe weather and climate events, such as droughts, wildfires, rising temperatures, flooding, air pollution, etc. Images of disasters (for example, the wildfires in Australia and California in 2020 and the evacuation of families, extreme rain, and flooding in the south of Belgium and parts of Germany in July 2021) are more quickly widespread than ever due to modern (social) media. Many different drivers and sectors (industry, farming, transport, trade, etc.) and individual behavior (consumption, heating, use of energy, transportation, holidays, etc.) are partly responsible for this environmental destruction. In this paper, we will concentrate on this environmentally relevant individual behavior, with the crucial general question if it can change for the better: is there a (general) willingness to reduce the environmental impact of individual behavior and is it possible that the COVID-19 experience could be a 'game-changer'?

Since the beginning of 2020, the world has been struck by the COVID-19 pandemic. COVID-19 provided a shock to our economy and to our lives as a whole. It brutally changed the way in which we organize our lives as individuals or households, as well as economies or societies. COVID-19 is a great challenge for our (mental) health, our economy, and our well-being, and it also has environmental side-effects (which can be positive or negative). The positive environmental effects are more important than the negative effects [1]. On the positive side, there is the improvement of the quality of air and

water, and the reduction of emissions and noise. On the negative side, there is the increased production of medical waste, more consumption of electricity and heating at home due to telework, and an increase in e-commerce and related transportation (because of more food ordering). Of course, the level of direct coercion to change behaviour is very high during a pandemic. The specific research question of this paper is the question of whether people are also voluntarily willing to take into account the environmental impact of their lifestyles (because of the experiences that are made possible by the COVID-19 crisis). According to McKinsey & Company (2020) [2], COVID-19 will drastically change consumer behavior in general. Changes will take place in how we work, shop, consume, learn, communicate, play. In these fields, the effect on the environment will be an indirect effect. Additionally, changes in how we travel are expected and an increase in domestic tourism is predicted. This can be directly positive for the environment. A study by the Swiss Re Institute (2020) [3] identifies five behavioral changes due to COVID-19: more digitalization, change in mobility (remote working), change in purchasing patterns, increase in health awareness, and change in interpersonal behavior (more divorce). Specifically, mobility changes can be can be very relevant for the environment. "The COVID-19 pandemic should lead to a critical reconsideration of the global volume growth model for tourism, for interrelated reasons of risks incurred in global travel as well as the sector's contribution to climate change." (Gössling, et al., 2021, p. 13) [4].

In this study, we were able to observe the environmental consequences of COVID-19 at the level of individuals, as we calculated the Ecological Footprint (EF) of respondents using a survey (similar to Verhofstadt et al. (2016) [5] and Bleys et al. (2018) [6]). The EF is frequently used to measure the environmental impact of individuals' lifestyles. It is the first key variable of this work. We examined if and how the EF changed (declined) during the period of the pandemic (compared to 2017) and also explore the role of other drivers of the EF. Next, we examined if there is a difference between different components of the EF (food intake, energy and paper use, car use, use of public transportation use, and travel behaviour). There is a large amount of the literature studying and measuring environmentally relevant behavior at the level of households or individuals (sometimes called pro-environmental behavior) [7–13]. In all interpretations of environmentally relevant behavior, it is assumed or defined that the behavior is an act of free will (of course, constrained by prices and preferences) to preserve the environment by limiting the impact of human activity. An important feature of COVID-19 is that, in most cases (and) for most kinds of behavior, there was no free choice. Changes in behavior had to be made because of rules and instructions that were forced upon the people as a result of the public health emergency.

So, we wondered whether there is also a voluntary willingness to reduce the EF (WtREF) without the COVID-19 obligations. This second key variable is a novelty of this research: we also explored the individuals' voluntary willingness to reduce their environmental impact, i.e., to reduce their Ecological Footprints. Could it be possible that COVID-19 created a 'new kind of environmental awareness'? According to BCG, Boston, MA, USA (2020) [14], surveying 3249 people in different countries, the COVID-19 crisis created new opportunities: 70% of people are more aware "that human activity threatens the climate and that environmental degradation can threaten humans" [14]. In general, people are more concerned with all kinds of environmental topics. The highest concern is found in the age group of people 25 to 44. Important for comparison with our results is that 40% of this group wants to exhibit more sustainable behavior. Traveling is among the categories where willingness to change is lowest, together with eating meat and buying fair trade ([14], slides 8 and 9). The picture provided by the survey of IPSOS, Paris, France (2021) [15] is less optimistic: "Fewer consumers say they have changed their behavior due to climate concern than did before the pandemic". We measured and compared the WtREF for the pre-COVID-19 year 2017 and for 2021.

WtREF represents an individual's intention; it does not automatically lead to a change in behavior. The same holds for the effect of COVID-19 on environmental concern and

awareness, as it is investigated by Refs. [16–18]. Environmental concern is the third key variable (next to the EF and the WtREF) that we will examine for 2021 and compare to 2017 to see if there is a significant influence of COVID-19.

In the next sections, we first present the data (collection) and the multivariate methodology. Then, we discuss the effect of COVID-19 on the EF, willingness to reduce the EF, and environmental concern by comparing the different periods 2017 and 2021. After that, we introduce other potential determinants of these three key concepts to see if the influence of COVID-19 remains. We conclude with a discussion about and summary of the most important findings.

2. Materials and Methods

Our empirical research is based on specific data collected in Flanders, the northern Dutch-speaking part of Belgium. Our analysis is based on information obtained from three separate surveys. We call the survey LEVO, which is short for Levensomstandigheden in Vlaanderen Onderzocht and is Dutch for "Inquiry into the life circumstances in Flanders". The LEVO survey has been carried out yearly since 2010 with a focus on subjective well-being measures and their determinants. The three editions that are used here include an additional series of questions on the Ecological Footprint and environmental behaviour. The survey followed the rules of the ethical code at Ghent University in full. The individuals responsible for the data collection, who acted on behalf of Ghent University, were personally available in case of any further questions or requests of further information on the goal, content, and data processing of the survey. We have data from before the COVID-19 crisis in 2017 (n = 2035) and during the COVID-19 crisis at two moments in time: February 2021 (n = 849) and October 2021 (n = 1559). For most of 2020, since March 2020, in Belgium, the restrictions on individual behaviour were more severe (some periods of complete lockdown, only essential movements and transportation allowed, compulsory telework, and all travelling prohibited) than was the case for most of 2021. An important difference between the two COVID-19 time slots is also that, in October 2021, most of the respondents were vaccinated (twice). Additionally, in the Fall of 2021 there was a general feeling that it was possible that the pandemic would 'come to an end'. This was not the case in the beginning of 2021. For each of the three surveys, the methodology was the same: a quota sampling of respondents who had to fill in a questionnaire on paper or online.

Respondents are weighted in the different samples to achieve similarity to the (univariate) frequency distributions for socio-economic situation, educational level, gender, and age. Chi-square goodness of fit tests show that the univariate distributions for the weighted samples are not significantly different for socio-economic position (p = 0.999), gender (p = 0.944), and educational level (p = 0.777). For age, the means do not differ significantly (one-way ANOVA, p = 0.395). Table 1 provides the descriptive statistics for the three samples.

First, we conducted a basic bivariate analysis to find out if there is a correlation between our key variables and the COVID-19 period. From a methodological point of view, if we found that there is an influence of COVID-19 on the EF, WtREF, and environmental concern, we would have to examine if this influence remains when other variables are introduced in a multivariate setting). In the regression analysis, we included variables that we found by overviewing established results concerning the drivers of pro-environmental behaviour. We used IBM SPSS Statistics 28. The first group of variables are the traditional socio-economic features, including age, gender, marital status, education, and income [9,19–22]. Second, we found some explanatory variables more closely related to the individual: personality traits, beliefs, and values [7,9,12,23,24]. Third, we found variables related to the 'relation between the individual and nature': environmental concern and awareness, environmental knowledge, and connectedness to nature [8–10,12,25,26]. A specific factor that many researchers do not include in their analysis is the influence of past or present behaviour on future or expected behaviour [11,25]. In the context of our research, this implies exploring whether there is an association between an individual's actual EF and his/her willingness

to change the EF. Of course, we also introduced a new (dummy) variable in the analysis: what is the influence of COVID-19 (comparison between 2017 and 2021)?

Table 1. Description of the three samples.

	Sample 1 2017 *n* = 2035	**Sample 2 February 2021 *n* = 849**	**Sample 3 October 2021 *n* = 1559**
Socio-economic position			
Working full-time	40.50%	41.00%	39.10%
Working part-time	14.50%	13.50%	14.90%
Student	6.40%	6.00%	6.40%
Pensioner	20.90%	22.00%	21.70%
Unemployed	6.30%	6.30%	6.40%
Incapable to work	5.70%	5.40%	5.70%
Househusband/wife	5.80%	5.70%	5.80%
Educational level			
Lower education	6.90%	4.80%	6.50%
Lower secondary education	16.10%	16.00%	15.30%
Higher secondary education	37.40%	38.50%	38.00%
Bachelor	24.10%	25.20%	24.50%
At least master	15.60%	15.50%	15.80%
Gender			
Men	49.90%	49.30%	50.00%
Women	50.10%	50.70%	50.00%
Age (mean)	48.50	48.76	49.45

3. Results: Environmental Impact and Concern during the COVID-19 Crisis

In this section, first, we examine the influence of COVID-19 on the EF, WtREF, and environmental concern by comparing 2021 to 2017 (bivariate analysis). Second, we introduce other potential determinants (multivariate analysis) of these three key concepts.

3.1. The Basic Findings

To measure the environmental impact of human behavior, we used the Ecological Footprint (EF). This composite indicator is widely accepted as the world's primary measure of humanity's demand on nature. The EF is expressed in global hectares (gha) and captures "how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices" (GFN, 2022) [27]. The EF of each individual respondent in our dataset was calculated using Ecolife vzw's footprint calculator that was developed in 2011 for WWF Belgium using data from the Global Footprint Network's National Footprint Accounts 2010. The Ecological Footprint of an individual is made up of seven components: food intake, heating, electricity, paper use, car use, public transport use, and holiday travel behaviour. The family composition was taken into account where relevant to rescale family-level impacts into individual impacts (for heating, paper use, car use, public transport use, and holiday travel). For the individuals in our samples, the EF is on an average of 6.44 global hectares. This is very much in line with EF data for Belgium. According to the Global Footprint Network the average per capita footprint in Belgium was 6.6 gha in 2017 [27]. Figure 1 presents the EF in general and also for the different components in the three time periods. The variation in the EF and its components fully reflect changes in behaviour as the same EF methodology (i.e., footprint coefficients) was applied in the different surveys.

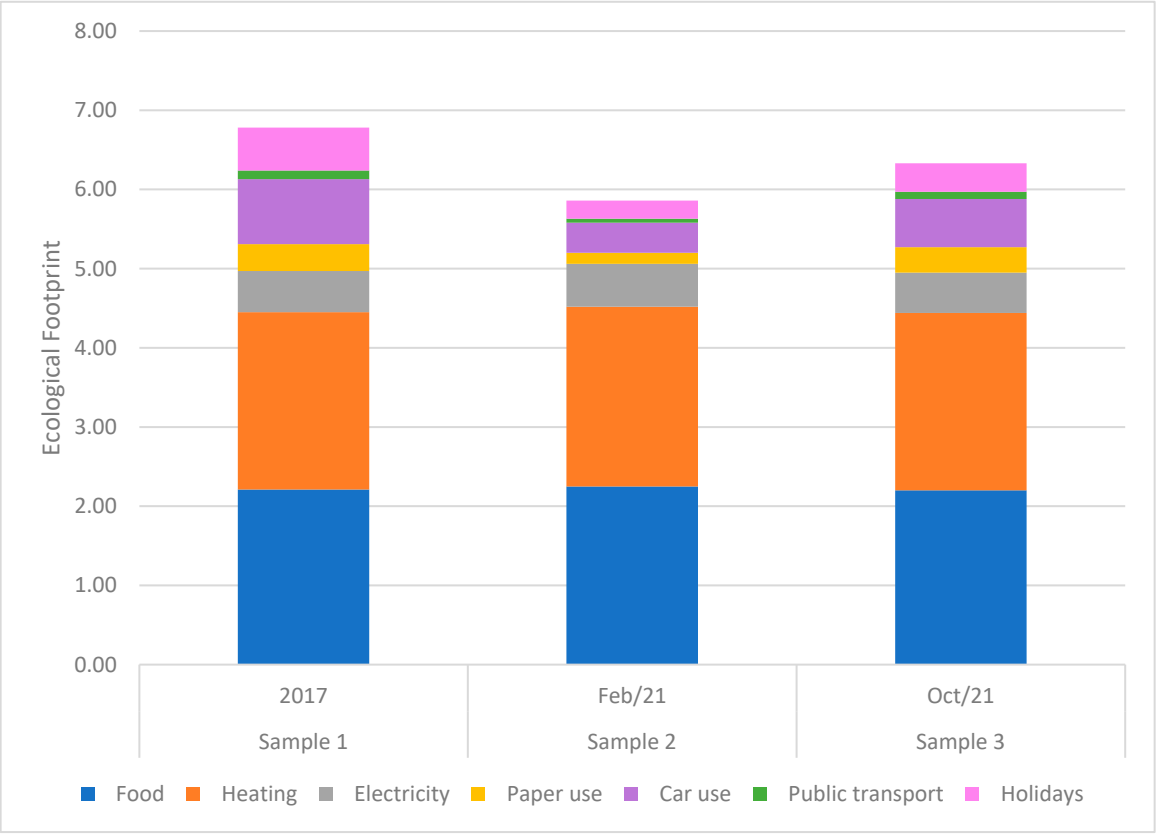

Figure 1. Ecological Footprint during the different time periods.

Except for electricity and heating, one-way ANOVA analysis shows that the EF and subcomponent means are not equal across the three samples ($p < 0.032$). Tamhane's post hoc test points to significant differences in the EF in the three time periods ($p < 0.001$). The EF is significantly lower during the COVID-19 crisis and this was the case mainly in early 2021, where respondents' answers reflect the first waves of COVID-19 with broader lockdown measures. For the EF components of paper use, car use, public transport use, and holidays, Tamhane's post hoc tests also point to significant differences in EF component between the three time periods ($p < 0.002$). In general, we see a decrease in early 2021 and a partial recovery by October 2021. The recovery is more pronounced for paper use and public transport use and less for car use and holidays.

The lower EF in February 2021 can largely be understood as being the result of behavioral changes that were compulsory (forced telework, travelling restrictions, etc.). Could it be possible that this reduction in EF is long-lasting? The indicator we use for this question is the willingness to reduce the Ecological Footprint (WtREF) for the seven domains of the EF. For all domains, respondents were asked in 2017 whether they were satisfied with what they are doing, or whether they want to make more or even much more changes to their lifestyles to reduce their EFs. Due to the restrictions on behavior in 2020 and 2021 (mainly on transport and holidays), leaving the answering categories in 2021 unaltered for all domains would imply that what people were willing to do was not at all comparable to 2017. As in 2021, people had an EF that was lower due to the restrictions (see Figure 1), so maintaining that lower level would already be an achievement. Therefore, the answering options for car use, public transport, and holidays were rephrased for the 2021 surveys: being satisfied with what they were doing pre-COVID-19 (allowing the comparison with the normal situation in 2017), maintaining the behavior of the COVID-19 period (comparable to making changes in lifestyle in normal times as in 2017), or making additional efforts.

Figure 2 presents the WtREF for the different domains. It makes clear to what extent people are willing to change their lifestyles and to reduce their EFs. Overviewing all EF subcomponents, we see that there is no domain for which more than 30% to 40% of the respondents are willing to do more. This decreases to 20% and to 25% for public transport and car use, respectively. The WtREF is the lowest for traveling, with only about 10% of the respondents willing to change their lifestyle. About 90% of the respondents want to keep on having holidays on a level with and in a way comparable to the pre-COVID-19 situation. Chi-square goodness of fit tests show a significant relation ($p < 0.011$) between the time period and the willingness to change concerning car use, public transport use, and holidays. In February 2021, people really wanted to return to the pre-COVID-19 level and thus did not consider the lower COVID-19 level as an opportunity to reduce their EFs in the long run. The percentages of being satisfied with the pre-COVID-19 level are even higher than in 2017 (especially for car use and public transport), again suggesting a strong desire to return to pre-COVID-19 life. In October 2021, probably with the belief that it was possible that the pandemic would come to an end, the percentages are more comparable to those found in 2017. For holidays, there is even a small increase in the willingness to do something, though it clearly remains the domain where people are willing to make the least changes to their lifestyles.

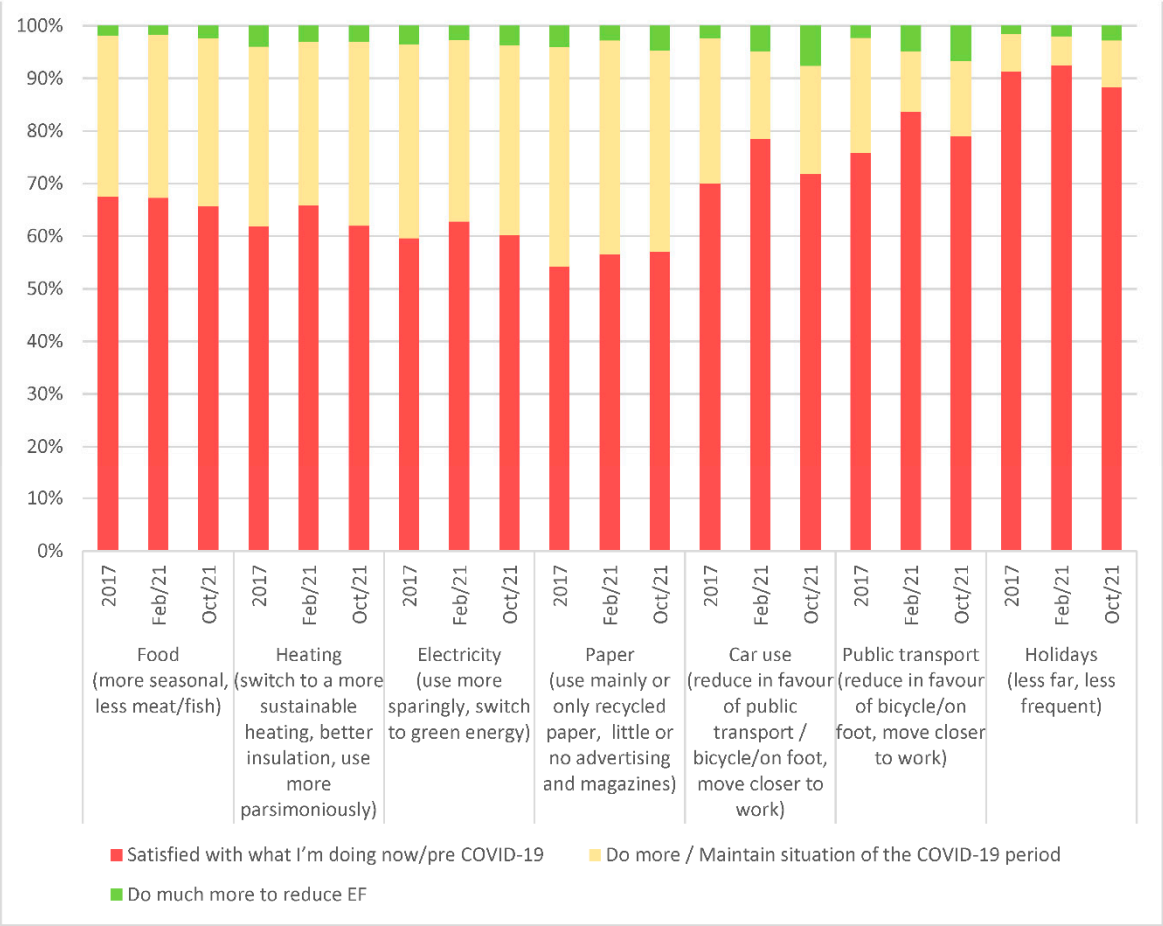

Figure 2. Willingness to change lifestyles in order to reduce the EF during the different time periods.

While the EF reflects actual behavior, the WtREF reflects an intention. On the other side of the spectrum (behavior–intention–awareness or concern), we also have information about the respondents' 'environmental concern' during the three different time periods (Figure 3 below). Environmental concern is measured on a seven-point scale indicating whether people have 'no concern at all' (1) to 'being very highly concerned' (7). For this

indicator (as for the EF), we observed a decrease in early 2021 and a partial recovery in October 2021. In February 2021, the concern for the environment was significantly lower than in 2017 (post hoc test one-way ANOVA, $p = 0.019$) and the other differences are not significant. So, while peoples' lifestyles had lower environmental impacts due to COVID-19 at the beginning of 2021 (having a lower EF, Table 2), we found that, at the time, people had a strong desire to return to a pre-COVID-19 life (having a lower WtREF, Figure 2) and they were less concerned about the environment (Figure 3).

Table 2. Determinants of the EF and environmental concern. Unstandardized coefficients (b) and standardized coefficients (beta) of OLS regressions.

	EF			Concern		
	B	**Beta**		**B**	**Beta**	
Age	0.009	0.170	***	0.005	0.086	***
Gender (woman)	−0.086	−0.043	**	−0.008	−0.004	
Lower educated	−0.025	−0.010		−0.191	−0.079	***
Higher educated	0.060	0.030		0.170	0.083	***
In a relation	−0.142	−0.059	**	−0.101	−0.042	**
Widow(er)	0.551	0.136	***	−0.319	−0.079	***
Number of children	−0.162	−0.215	***	0.015	0.020	
Being religious (yes)	0.025	0.017		0.036	0.025	
Personal income (in thousands €)	0.023	0.024		−0.024	−0.025	
Centre of municipality	0.002	0.001		0.033	0.016	
Rural	0.186	0.085	***	0.082	0.038	
Outskirts of town	0.002	0.001		0.134	0.057	**
Introvert	−0.016	−0.026		0.008	0.014	
Agreeable/tolerant	−0.033	−0.057	***	0.066	0.112	***
Emotional	−0.011	−0.017		0.012	0.019	
Conscientious	−0.002	−0.002		0.044	0.067	***
Conservative (not open to experience)	0.019	0.030	*	−0.057	−0.090	***
Honest	−0.037	−0.046	**	0.074	0.092	***
Sample_dummy_feb2021	−0.601	−0.246	***	−0.217	−0.089	***
Sample_dummy_oct2021	−0.301	−0.138	***	−0.142	−0.065	**
Parents during childhood	−0.056	−0.075	***	0.154	0.206	***
Concern about environmental issues	−0.113	−0.155	***			
Ecological Footprint				−0.086	−0.157	***
Nagelkerke R^2		0.178			0.160	

*** $p < 0.01$/** $p < 0.05$/* $p < 0.10$.

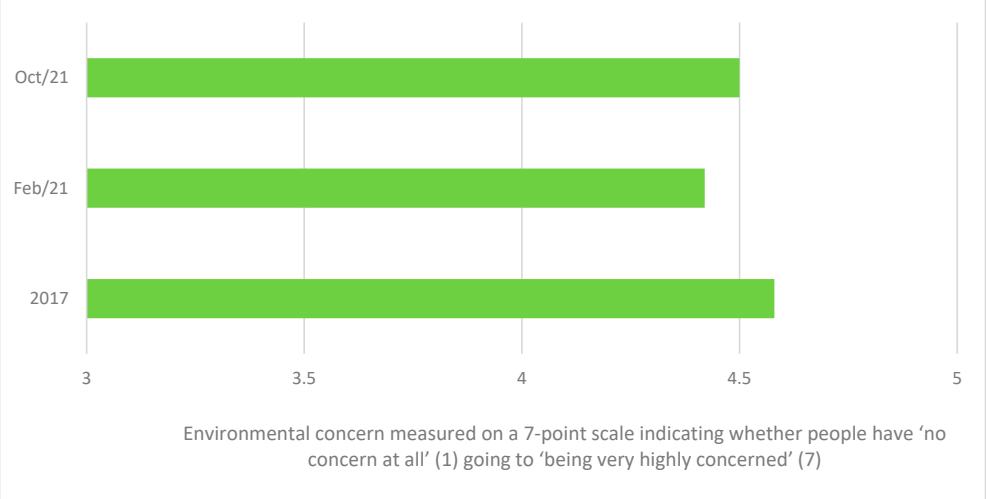

Figure 3. Environmental concern in the different time periods.

3.2. Multivariate Analysis

From the Section 3.1, we learned that the impact of COVID-19 on the relationship between individuals' lifestyles and the environment results in a lower environmental impact (a lower EF), but at the same time, a lower WtREF and less environmental concern. The question now is to see if that effect of COVID-19 also holds when we control for other possible determinants.

In Table 2, we present the multivariate analysis for the EF and environmental concern. The overall WtREF is the dependent variable in Table 3. In order to obtain a general indicator of the willingness to reduce the EF, we used the average of the seven items (Cronbach alpha = 0.694) from Figure 2. The three dependent variables (EF, WtREF, and environmental concern) are made comparable by using standardized scores. Table A1 shows that the willingness to reduce the EF is positively correlated for all components of the EF.

Table 3. Determinants of the WtREF (all components). Unstandardized coefficients (b) and standardized coefficients (beta) of OLS regressions.

	Model 1			**Model 2**			**Model 3**		
	B	**Beta**		**B**	**Beta**		**B**	**Beta**	
Age	–0.011	–0.202	***	–0.011	–0.200	***	–0.012	–0.211	***
Gender (woman)	0.068	0.034	*	0.067	0.034	*	0.068	0.034	*
Lower educated	–0.142	–0.059	**	–0.096	–0.040	**	–0.097	–0.040	**
Higher educated	0.101	0.050	**	0.066	0.032	*	0.063	0.031	
In a relation	0.039	0.016		0.056	0.023		0.068	0.028	
Widow(er)	–0.106	–0.026		–0.031	–0.008		–0.072	–0.018	
Number of children	0.046	0.060	**	0.040	0.053	**	0.055	0.073	***
Being religious (yes)	0.021	0.015		0.013	0.009		0.021	0.015	
Personal income (in thousands €)	0.024	0.024		0.033	0.034	*	0.031	0.032	*
Centre of municipality	–0.020	–0.009		–0.021	–0.010		–0.025	–0.012	
Rural	–0.004	–0.002		–0.008	–0.003		–0.026	–0.012	
Outskirts of town	0.058	0.024		0.032	0.014		0.036	0.015	
Introvert	0.000	0.000		–0.002	–0.004		–0.001	–0.002	
Agreeable/tolerant	0.025	0.043	**	0.006	0.011		0.006	0.010	
Emotional	0.027	0.043	**	0.024	0.038	**	0.024	0.040	**
Conscientious	–0.041	–0.062	***	–0.050	–0.075	***	–0.051	–0.077	***
Conservative (not open to experience)	–0.011	–0.018		0.004	0.006		0.005	0.007	
Honest	–0.032	–0.039	**	–0.048	–0.060	***	–0.046	–0.058	**
Sample_dummy_feb2021	–0.149	–0.061	**	–0.117	–0.048	**	–0.089	–0.036	
Sample_dummy_oct2021	0.011	0.005		0.036	0.016		0.037	0.017	
Parents during childhood				0.020	0.026		0.024	0.032	*
Concern about environmental issues				0.149	0.203	***	0.157	0.215	***
Ecological Footprint							0.036	0.066	***
Nagelkerke R^2		0.070			0.110			0.114	

*** $p < 0.01$/** $p < 0.05$/* $p < 0.10$.

Next to the sample dummies (2017 is the base year), the independent variables in the three models are the drivers of environmentally relevant behavior (derived from the literature) that are summarized in the introduction: socio-economic and personal variables and environmentally related variables. We also used the Ecological Footprint. Of course, there are modifications (variables are in- or excluded) depending on the specific model (dependent variable) that is examined.

For the socio-economic variables, we included age, number of children, and personal income as scale variables. We used dummies for gender, educational level (dummies for lower and for higher educated than higher secondary education), having a relation or being widower (being single is the reference category), religion, and specification of residence (living in the city center is the reference category). The individual's socio-economic position

is not included in the models presented here, because this is highly correlated with other socio-economic variables, such as age, income, and educational level.

For the personal variables, the respondents were asked to rate themselves on the HEXACO personality traits: honesty, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience [28] (Ashton and Lee, 2007). The main difference with the Big Five personality traits is the addition of the "honesty" trait that relates to personal integrity [29].

Table 2 shows the determinants of the EF and environmental concern. We used the socio-economic and personal variables and two environmentally related variables. The first one is environmental concern (of course, only used to explain the EF). The second one is an average of two items based on the extent to which the respondents' parents talked about (or made decisions taking into account) environmental issues (Cronbach alpha = 0.805).

Table 2 confirms the trend for both the EF (Figure 1) and the environmental concern (Figure 3): there is a decrease for both dependent variables in early 2021 and a partial recovery by October 2021. Associated with COVID-19, we observed less concern about the environment and, at the same time, a more environmentally friendly lifestyle (and a lower EF because of the compulsory changes in lifestyle). These results remain after taking into account the effect of all the other explanatory variables that are included in the models. Of course, many different things have happened during the period of COVID-19, but we think it can be assumed that the pandemic was the dominant feature of that period so that the dummy effect can be interpreted as a COVID-19 effect.

The effect of other determinants is in line with the existing literature. For example, in line with Büchs and Schnepf (2013) [19], we see a less environmentally friendly lifestyle (higher emissions in [19] and a higher EF in our analysis) for older people, men, widow(er)s, and respondents living in smaller households and living in rural areas. Comparable to Ericson et al. (2014) [30], being more tolerant and less conservative contributes to a more environmentally friendly way of living (in our model, both a more environmentally friendly lifestyle and also more concern). Personality traits in general are rather important for environmental concern, and the role of the parents is more important for concern than for the actual behaviour. Similar to [31], Table 2 shows that higher educated respondents reported to be more environmentally concerned, yet this does not result in actual behaviour. Finally, note that more concern is associated with having a lower EF.

In Table 3, we examine the WtREF. We show three models, each time including additional variables to increase our potential understanding of the (inter)relations and effects. We started with a model that only includes the socio-economic and personal variables (Model 1), before adding the environmentally related variables (Model 2) and, finally, the Ecological Footprint (Model 3) as it was calculated for Figure 1. Including the EF joins in with the call of Joshi and Rahman (2017) [11] and Lee (2014) [25] to include current or past behavior as drivers for future behavior.

Younger respondents who have a lower EF (Table 2) also have a significantly higher willingness to make efforts for the environment. Additionally, women, people with more children, and people that are more emotional are more willing to change their lifestyles. More conscientious and honest people reported a higher environmental concern but a lower willingness to do reduce their footprint. The significant positive effect of a higher educational level diminishes when including environmental concern (in Model 2). Concern about the environment (of which higher educated respondents have more) is thus more of a determinant than the educational level. In addition to age, environmental concern is the most important driver.

In line with Figure 2, Models 1 and 2 show a lower willingness to reduce the footprint in February 2021. However, this effect disappears when we include the Ecological Footprint in Model 3. This points to a higher (lower) willingness to make efforts when the Ecological Footprint is higher (lower). People might see more room for improvement (to decrease their footprint) if they actually have a higher footprint. This effect (from the EF and WtREF) outweighs the COVID-19 effect.

In Table A2, we consider the WtREF for each component separately and use ordered logit estimates.

The separate models confirm the positive impact of being younger (except for holidays) and having a higher concern for the environment. The result that more conscientious and honest people report a lower willingness to reduce the EF is most present for holidays. In the general model from Table 3, the influence of the parents was limited. Table A2 shows their important role in reducing the EF, mainly with respect to transport and holidays.

The finding that a higher footprint induces a higher willingness to do reduce the EF is valid for all components except for public transport and holidays (Table A2). For public transport, there was a lower willingness to reduce the EF in February 2021. However, this cannot be attributed to the lower footprint in that period. Perhaps transportation by bicycle and on foot are considered less of an alternative for public transport and moving closer to work is in contrast with the search for a more rural living. As a survey among 2000 house hunters in Flanders shows, living near greenery has become more crucial and more than three out of four people only want to buy a house with a garden [32]. For holidays, the somewhat higher willingness to make efforts in October 2021 (from Figure 2) is confirmed here. It seems that two summer seasons with travelling restrictions made us realize that travelling somewhat less frequently or less far could be fine. However, as we can see in Figure 2, even in October 2021, travel is the domain where we want to make the lowest effort to reduce our footprints.

4. Discussion

Obviously, the COVID-19 situation had a serious impact on individual behaviour and also on environmentally relevant behaviour. In order to prevent infections and health problems, at certain moments in 2020 and 2021, shops and bars were closed and transport and travelling were prohibited, it was not allowed to travel abroad or to go on holiday. At the end of 2021 and in early 2022, the restrictions were relaxed but they did not yet completely disappear. This situation was reflected in a lowering of the EF in Flanders in 2021 (compared to 2017). Looking at the components of the EF, not surprisingly, the lower EF was explained by the decline in car use and holiday traveling. The driving forces here are the governmental measures in the field of compulsory working from home and restrictions on (international) travelling. Given the forced nature of this change in behaviour, an important question is whether it is possible that the change can be more systemic, leading to a voluntary and long-lasting change in behaviour. Is it possible that the COVID-19 crisis has a positive consequence that it leads to a lower EF in the long run? For our answer to this research question, we asked the respondents for their willingness to reduce their Ecological Footprints for the seven different components of the EF. We found that there is a positive correlation between all components of the actual EF (except for public transport and holidays) and people's willingness to reduce the EF. So, a lower (higher) footprint goes together with a lower (higher) willingness to change the lifestyle. It turns out that some people (but never more than about 40% of the population) are willing to make efforts in most domains. This willingness to change is lower (about 20% of the population) for car use and is lowest (about 10%) for a change in travel behaviour (holidays). In general, people do not have many spontaneous intentions to try to reduce their EFs. COVID-19 is not inspiring people to change their behaviour. About 90% of the population wants to keep on having holidays as it was the case in the pre-COVID-19 situation. This is in contrast with the prediction made by the OECD (2020) [33] that, for tourism, a return to business as usual is highly unlikely. Additionally, McKinsey & Company (2020) [2] and the Swiss Re Institute (2020) [3] expect a change in mobility patterns (because of more teleworking) or even in travel patterns (because of more domestic tourism). The results of the work of O'Garra and Fouquet (2022) [34] for the UK did point to a willingness to reduce travel consumption, but people were asked about "their willingness to reduce consumption over the longer term in support of a low-carbon pathway beyond COVID-19" (p. 2). In our survey the question was unconditional.

Moreover, in February 2021, the concern for the environment was significantly lower than in 2017. While COVID-19 forced upon people a lifestyle with less environmental impact (lower EF), it did not fundamentally change environmentally relevant behavior or concern. In most cases, the respondents simply wanted to return to their pre-COVID-19 lifestyles. This conclusion is in line with Lucarelli et al. (2020) [35] and Hynes et al. (2021) [36], who found no changes in environmental preferences and intentions, respectively.

However, there is a role here for some public policy interventions that might make us benefit from a potential win-win situation. Taking the example of working from home, it is obvious that both the environment and the employee can benefit. Moreover, people are used to working from home and want to keep this change, at least for a couple of days a week. [37]. Policy should take advantage of those new kind of opportunities that were not there before COVID-19. The same holds for the increased levels of cycling since COVID-19 [38]. Pro-cycling policies can get more public support now compared to some years ago.

We further explored the drivers of the EF, WtREF, and environmental concern with a multivariate analysis, also looking for the influence of (next to the COVID-19 situation) some socio-economic and personal variables and environmentally related variables. We know that the data and our methodology do not allow us to draw conclusions about causal interference; strictly speaking, what we found are correlations. In addition, of course there were other things happening between 2017 and 2021 at a societal or policy level (e.g., change in environmental policies). However, the effects that we found are as can be expected from the existing literature [19,30,31]. Older people, men, widow(er)s, lower-educated respondents, and respondents living in smaller households and living in rural areas have a less environmentally friendly lifestyle. Having more environmental concern is also associated with a lower EF. Knowing that environmental concern is a main driver, creating (more) awareness and concern is a traditional policy prescription, of course, also in an educational setting [39]. Personality traits in general and also the role of parents are more important for environmental concern. Looking at the willingness to reduce the EF, we found that age (being younger) and concern for the environment are the main drivers for making lifestyle changes and reducing environmental impact. We saw that the effect of the COVID-19 period disappears when we included the EF in the model. Additionally here, as in the correlation analysis, we found a higher (lower) willingness to change one's lifestyle when the actual Ecological Footprint is higher (lower).

These findings should be the subject of further research to find a proper explanation. Joshi and Rahman (2017) [11] and Lee (2014) [25] advise the inclusion of current or past behavior as drivers for future behavior. Following this line of thought, it is a hypothesis that people with a higher EF (compared to those with a lower EF) think that future changes in lifestyle are easier to make. Moreover, additional research is needed to confirm our interpretation of the time dummy effect as representing a COVID-19 effect. We call for researchers who have been collecting panel data on environmental behaviour (before, during, and after the COVID-19 period) to see if they can confirm or refine our findings. We would like to repeat this study at a moment when COVID-19 is 'really finished'. We define this as a moment where we can say that all 'catch-up activities' (that we are observing now in 2022) have taken place. Maybe then, in 2023 or 2024, people will have other intentions or preferences for a more quiet live.

In summary, we find that the lower Ecological Footprint (at the beginning of 2021) due to COVID-19 remains an exceptional and compulsory situation. The COVID-19 situation even reduced the WtREF and the environmental concern of our respondents. At the beginning of 2021, people wanted a 'return to normal'. This is not promising: we cannot expect changes for a future (after COVID-19) without a fundamental change in lifestyle and a resulting lower Ecological Footprint. Government policies should exploit the potential that is created by COVID-19. Of course, our findings and suggestions are to be reproduced for other regions and countries (in Europe) in order to have a more general validity. This paper can be seen as an invitation to conduct comparable investigations.

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Data Availability Statement: The survey data presented in this study are available on request from the corresponding author. The individual level data for the ecological footprint are not publicly available due to the fact that the calculations are copyright by Ecolife vzw.

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Appendix A

Table A1. Spearman correlation between components of the WtRef.

	Food	Heating	Electricity	Paper	Car Use	Public Transport
Heating	0.267 ***					
Electricity	0.252 ***	0.563 ***				
Paper	0.26 ***	0.249 ***	0.295 ***			
Car use	0.218 ***	0.155 ***	0.174 ***	0.261 ***		
Public transport	0.176 ***	0.159 ***	0.189 ***	0.21 ***	0.447 ***	
Holidays	0.14 ***	0.12 ***	0.136 ***	0.127 ***	0.235 ***	0.274 ***

*** $p < 0.01$.

Table A2. Determinants of the WtREF for each EF component (ordered logit estimates).

	Food	Heating	Electricity	Paper	Car Use	Public Transport	Holidays
Age	–0.015 ***	–0.024 ***	–0.024 ***	–0.023 ***	–0.018 ***	–0.015 ***	–0.003
Gender (woman)	0.234 **	–0.054	0.06	0.177 **	0.202 **	0.155 *	0.182
Lower educated	–0.241 **	–0.042	–0.07	–0.244 **	–0.285 **	–0.075	–0.258
Higher educated	0.328 ***	–0.006	0.007	0.058	0.171 *	–0.063	0.048
In a relation	–0.057	0.164	0.25 **	0.23 **	0.208 *	0.059	–0.053
Widow(er)	–0.142	–0.274	–0.421 *	–0.043	–0.403	–0.158	–0.83 **
Number of children	0.017	0.11 **	0.127 ***	0.098 **	0.155 ***	0.081 **	0.082
Being religious (yes)	0.15 **	0.049	–0.032	0.082	–0.011	–0.032	–0.091
Personal income (in thousands €)	0.09 **	0.062	0.093 **	0.022	0.062	0.013	–0.027
Centre of municipality	–0.128	–0.187 *	–0.033	0.172	0.137	0.2	–0.017
Rural	–0.091	–0.193 *	–0.013	0.283 **	0.116	0.096	–0.042
Outskirts of town	–0.01	–0.168	0.049	0.24 **	0.258 *	0.229	0.078
Introvert	–0.007	0.033	0.043 *	–0.019	–0.004	–0.019	0.016
Agreeable/tolerant	0.038	0.019	0.01	–0.013	0.03	0.007	0.052
Emotional	0.063 **	0.041	0.009	0.062 **	–0.01	–0.026	0.06
Conscientious	–0.097 ***	–0.082 **	–0.058 **	–0.036	–0.054 *	–0.086 **	–0.154 ***
Conservative (not open to experience)	0.01	–0.043 *	–0.017	0.024	0.03	–0.007	0.055
Honest	–0.099 **	–0.046	–0.035	–0.022	–0.079 **	–0.09 **	–0.114 **
Sample_dummy_feb2021	–0.211 *	–0.226 *	–0.11	0.101	–0.253 *	–0.405 **	0.005
Sample_dummy_oct2021	–0.056	–0.064	0.044	–0.096	0.09	–0.083	0.49 **
Parents during childhood	0.036	–0.049 *	–0.001	0.008	0.103 ***	0.118 ***	0.174 ***
Concern about environmental issues	0.339 ***	0.196 ***	0.21 ***	0.286 ***	0.262 ***	0.218 ***	0.084 *
Corresponding EF component	0.419 ***	0.236 ***	1.159 ***	1.212 ***	0.216 **	–0.21	0.075
Nagelkerke R^2	0.120	0.076	0.097	0.091	0.101	0.061	0.050

Each component was measured on a three-point scale: see the heading in Figure 3. *** $p < 0.01$/** $p < 0.05$/ * $p < 0.10$.

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