

## **Societal wellbeing: Embedding nudges in sustainable cultural practices**

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## Abstract

This study provides a behavior analytic framework to a previous nudging experiment from Kalbekken and Sælen (2013). We are concerned with achieving societal wellbeing from a selection of cultures perspective, and we call for increasing synergies between the two fields. The original experiment achieved a 20% reduction in food waste among restaurant customers by implementing two independent nudges: reducing plate size and socially approving multiple servings. We use this experiment as an example to introduce an analysis of the social contingencies (metacontingencies) responsible for not only establishing, but also maintaining, sustainable behavioral repertoires. We show how reducing food waste can be a simple, economic, and effective example of a behavioral intervention when programmed with contingencies of cooperation. Furthermore, we generalize our model to social architectures that create and sustain cultural practices.

Namely, our model addresses the long-term effects of nudging as a result of cooperation between stakeholders, and how they are maintained by feedback loops. Whereas the aggregate effect of individual choice behavior can affect food consumption significantly, it may not suffice to change an enduring cultural practice. We argue a behavior analytic approach in studying complex systems informs nudging applications at the policy making level.

*Keywords:* nudging, metacontingency, food waste, cooperation, choice architecture, environment, macrocontingency

### **The rise of behavioral solutions in policymaking**

Addressing some of the most prolific, difficult and expensive social problems affecting our health, labor and environmental policies calls for adopting behavioral solutions (Halpern, 2015; Obama, 2006; OECD, 2017a). Consequently, numerous government-affiliated units and networks have been established to apply findings from behavioral economics. The policies derived from nudge theory aim to improve citizens' policy-regulated behavior. Some of the most well-known governmental units include the Behavioral Insights Team in Westminster, London (est. 2010), the New South Wales Behavioral Insights Team in Australia (2012), the Social and Behavioral Sciences Team in Washington D.C. (2015), and the Qatar Behavioral Insights Unit (2016). We are clearly witnessing an endeavor towards achieving large-scale and sustainable change, by submitting to a behavioral perspective in governmental policymaking and regulation (OECD, 2017b). A thorough overview of the positive impact of a behavioral approach in consumer protection, environment, education, health and others may be retrieved from the Organization of Economic Cooperation and Development (OECD, 2017a).

We stress the challenge of sustaining behavioral interventions; not only initiating, but rather maintaining socially responsible behavior. For the purpose of this study, we consider socially responsible behavior as a synonym of cooperation, specifically implied by (a) interdependency between agents, and (b) dual-feedback process (internal and external). The concept of *metacontingency* (Glenn, 1986) best captures the cooperation among stakeholders to achieve positive and lasting societal solutions. A metacontingency is the functional relationship between the product of coordinated individual behaviors, and their selecting contingencies, for example, the system that receives it.

We illustrate our model by fitting it to an example of cooperation aimed at nudging less food waste in a supplier-consumer context. The original study bears important policy

implications on portion size, response cost-efficiency, and environmental footprints. Nonetheless, we may have chosen any other example of nudging involving both interdependent behavior and feedback loops. For instance, behavioral insights were used in overprescribing antibiotics in health policy (OECD, 2017a, p. 265) and addressing the gender gap recruitment biases in labor policy (Bohnet, van Geen, & Bazerman, 2016).

### **The need for a behavioral perspective encompassing social issues**

The attempt to influence behavior through environmental manipulation dates long before the term *nudge* was formally introduced by Thaler and Sunstein (2008). The authors define a nudge as a soft form of paternalism, a guided choice behavior, with specific characteristics. *Choice architecture* refers to the intrinsic properties of the natural environment and the social context in which choice behavior takes place. The architecture cannot be avoided since choice must be arranged in some way and may be likely to influence our decisions (Sunstein, 2014). One of the most striking characteristics of the nudge concept is its “massive lack of originality”<sup>1</sup>. Nevertheless, nudges seem to possess large effect sizes (Benartzi et al., 2017), social impact (OECD, 2017b), and diffusion (Benartzi et al., 2017; Sunstein, Reisch, & Rauber, 2017; Thaler & Sunstein, 2008).

Drawing on the definitions of choice architecture, we introduce the term *social architecture*, to identify the arrangement of interdependent contingencies of behavior that comprise sustainable cultural practices. Whereas coordinated behaviors may be fortuitously selected (for good or bad), cooperation often refers to intentional acting together towards a common goal. In designing a social architecture, we endorse the latter sense of cooperation, while the more technical description of a metacontingency refers to coordinated behaviors selected by the contingencies (not necessarily the receiving system).

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<sup>1</sup> (Anonymous, personal communication, May 26, 2017).

It is plausible that cases of “subtle” nudges, or *sludges* (Thaler, 2018), may outweigh nudging ethical behavior or for the “greater good”. Sludges fulfill the economic or self-serving interests of the choice architect: that is, the designer of nudging interventions. For example, the European Commission recently banned pre-ticked boxes for the sale of additional products through web portals (European Commission Press release, 2014). Online marketers have been nudging us for some 20 years since the internet was born, even though the term nudge did not exist at the time. In the absence of the regulation provided by this ban, online sellers were permitted to push sales through defaulting, which is the most effective and preferred nudge {Sunstein, 2014 #211; Sunstein, 2016 #966}. Choice architects operate not only in traditionally for-profit domains (e.g., marketing, finance, manufacturing, etc.), but also in political, governmental and social settings. For example, the city of Boston engaged in a yearlong initiative to increase trust in governmental services through operational transparency (OECD, 2017a, p. 322).

Behavior analytic studies rarely sites the term nudge, insofar as arranging the architecture of choice means arranging contingencies of reinforcement (Tagliabue, Sandaker, & Ree, 2017). When contingencies are not possible (Alavosius, Getting, Dagen, Newsome, & Hopkins, 2009; Geller, 1989; Keller, 1991), nudges help manage organizational behavior through cooperation. Alavosius and colleagues implemented an incentive system in cooperatives to decrease work-related injuries. The authors call for an integration of behavioral system analysis and organizational behavior management in order to “produce lasting and significant benefit to large collectives of organizations” (Alavosius et al., 2009, p. 209). Capitalizing on the cooperation between members of a culture or community contributed to the good of the *commonwealth*: “[c]ontingencies operating on one individual interplay with contingencies for others such that their combined efforts yield benefit to all” (Alavosius et al., 2009, p. 195).

A behavioral analytic approach to nudging may therefore interpret the choice architecture as a form of arranging individual behavioral contingencies. Alternatively, we may interpret nudges through cultural selection as a form of arranging contingencies of cooperative behavior comprising cultural repertoires. Creating win-win interdependent behavioral repertoires between stakeholders sets the premises for sustainable behavioral change and maintenance (Biglan, 2015).

We mean to illustrate this point by presenting a nudging experiment as an example of cooperation towards achieving environmental sustainability (Kallbekken & Sælen, 2013). Specifically, the authors used interdependent contingencies to reduce food-waste. The strength of this study lies in its simplicity, economic affordability, and effectiveness. This study also tackles a critical issue for today's policy makers and citizens. In fact, the European Union estimates annual food waste near 88 million tons at the cost of 143 billion euros (European Commission, 2016). Aligning our model with this study offers a simple setup and resonance among the Scandinavian people. Nevertheless, the study did not seem to generate (direct) replication procedures in other countries.

If we have ambitions of large-scale behavioral change, we should use this experiment as an illustration of how the use of *macrobehavior*<sup>2</sup> and metacontingencies (Glenn, 2004; Glenn & Malott, 2006; Malott & Glenn, 2006) might produce additional value to nudge interventions. The paper demonstrates a win-win scenario, or a non-zero-sum game, between food suppliers and consumers, as long as the nudge remains in place. Cooperation between participants is key to the intervention's relevance and sustainability. We submit that a metacontingency analysis might add a third beneficiary: the environment. This system selects

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<sup>2</sup> "[T]he behaviors of many individuals having similar topographies that produce an effect at the level of the culture" (Glenn, 2004, in Delgado, 2012, p. 21).

and sustains the product of cooperation over time and endures across situations. This triangulation produces a sustainable cultural practice.

In the following section, we define nudge at a conceptual level and contextualize the term in a broader behavioral perspective by emphasizing its social value. Next, we present a summary of the two independent nudging experiments and their results. In the fourth section, we suggest a cultural framework meant to improve both current and future nudging research. Concluding, we discuss whether this and other experiments targeting societal wellbeing should address individual behaviors or the social architecture.

### **The definition of nudge in behavioral sciences**

A nudge is a simple environmental change meant to influence behavior without compelling it. Developments in behavioral economics and nudge related studies are at the height of their popularity at the conceptual and empirical levels. Expanding upon the findings of behavioral economists to precede him, Richard Thaler helped to mainstream the idea of nudging. He won the most recent Nobel in Economics and is the co-founding father of nudging<sup>3</sup>. The term nudge makes its first appearance in Thaler and Sunstein's 2008 book *Nudge: Improving Decisions about Health, Wealth and Happiness*. A nudge is a form of paternalism in its softest and most libertarian form. Embodied in the architecture of choice, Thaler proposes a nudge "alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2008, p. 6).

Various scholars have refined the definition and scope of nudging: Halpern (2015), Marchiori, De Ridder, Veltkamp, and Adriaanse (2015), Hansen (2017) and Mathis and Tor (2016), emphasize strict properties for nudges-to be defined as such. Furthermore, an innovative line of nudging and other concepts derived from behavioral economics has

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<sup>3</sup> Together with Cass R. Sunstein, the most recent Holberg laureate (2018) at the time of writing.

successfully approached public policymaking and governmental regulation. Scholars and policy makers alike refer to this application as *behavioral insights* (OECD, 2017a, p. 401).

Despite the multidisciplinary research initiatives feeding the establishment and the development of nudging and behavioral insights research, the contributions of behavior analysis are extremely limited. Based on our preliminary research, very few works seem to mention nudge explicitly and contextualize the term within a behavior analytic framework (e.g., Brandon, 2008; Rachlin, 2015). Even though descriptions of antecedent behavior control techniques have been addressed in community settings (Luyben, 2009), we record a lack of effort from behavior analysis in joining the conceptual and experimental work on behavioral insights.

Nudging represents more than a relatively new and exciting line of experimentation. In fact, nudging techniques are already included in the behavior analyst's toolkit and should be implemented more widely. Firstly, nudging techniques are behavioral in their function, since nudges aim at influencing a target behavior or a behavioral repertoire. Nudges are considered a display of means paternalism rather than ends paternalism (Sunstein, 2013). As such, nudges are more permissible forms of behavioral control. Secondly, nudging capitalizes on the influences that the natural and social environment have on behavior (Simon & Tagliabue, 2018). This may be traced back to some of Skinner's own works on behavioral selection and modification (Skinner, 1953, 1971).

Nudges address *choice* behavior, which represents an elective area of experimental inquiry in behavior analysis. According to the matching law (Herrnstein, 1961), the function of a nudges is to alter the probability of a behavior by changing the delayed reinforcement conditions under which it occurs. It does not eliminate the immediate reinforcement conditions under which the alternative behavior originally occurred. The point is not to



eliminate (or prohibit) unwanted behaviors, but simply to make them less probable. This is in line with basic behavioral analytic research.

In other words, nudging retains free choice behavior and excludes any forced choice behavior under concurrent schedules of reinforcement. Organisms naturally prefer the first one to the latter, which has been empirically demonstrated, largely with pigeons (e.g., Catania & Sagvolden, 1980; Cerutti & Catania, 1986, 1997; Rachlin & Green, 1972).

Through this study, we take an active step towards bridging the behavioral analytic and behavioral economic traditions and contributing to solving some of the “wicked problems”<sup>4</sup> for which behavioral solutions are being called. “Many of the problems that threaten the well-being of cultures are cumulative effects of this sort. Smoking, drug addiction, alcoholism and obesity are the result of practices that require a re-design of cultural-behavioral contingencies” (Delgado, 2012, p. 23).

The nudging approach serves as an appreciated assist to traditional economic incentive programs and legal regulations. With regard to social issues, nudging is often yields a higher return on investment (Benartzi et al., 2017), while better serving the needs of the people (obesity, diabetes, retirement savings), governments (tax collection, school attendance), and the planet (pollution and care for the environment).

### **The original study**

Kallbekken and Sælen (2013) tested the effectiveness of two nudges on food waste reduction in a major Scandinavian hotel chain from June 1 to August 15, 2012. The sample included 52 hotels with 38 in the control group and 14 in the test group. The test group was split in two (seven hotels each) where the guests were subject to one of the following test environments:

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<sup>4</sup> Wicked problems describe uniquely difficult and complex emerging policy problems and are conceptualized by ten characteristics in Peters, 2017.

- (1) Smaller plate size, reduced from 24 cm to 21 cm in diameter; and
- (2) A visual social cue emphasizing the acceptance of visiting the buffet more than once.

The sign read: “Welcome back! Again! And again! Visit our buffet many times.

That’s better than taking a lot once” (Kallbekken & Sælen, 2013, p. 326).

The statistically significant ( $p < 0.001$ ) results are reported in Table 1. The authors recorded a reduction in food waste of 19.5% from the plate size nudge and 20.5% from the social cue nudge (Kallbekken & Sælen, 2013).

In addition, the authors conducted estimates of coefficients analysis concerning the observational difference for each nudge at a statistically significant rate, taking into account guest satisfaction and food sales. These estimates quantify differences-in-differences, and they report an approximation of the financial savings and CO<sub>2</sub> emissions in food waste for each centimeter of decrease in plate diameter size. Given the purpose of this paper, we choose not to elaborate on these data and refer the reader to the original article for further specifications and results.

Data from follow-up online surveys did not show any decline in customer satisfaction<sup>5</sup>, and the hotel attained economic (and environmental) cost reduction. Based on these findings, the authors see a win-win scenario between the stakeholders of the hotel chain and the customers.

### **Nudging and the redesign of contingencies including all terms**

In the experiment illustrated above, nudging takes the form of intervening on the antecedents in order to promote behavior change in a forecasted way. Specifically, the intervention consists of adding two independent discriminative stimuli that enable access to

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<sup>5</sup> Which may yet be paraphrased as a win-*non-loss* scenario, without affecting the main claim of our analysis.

the natural reinforcer ( $S^R$ ) of participatory commitment to making efficient use of environmental resources (namely, not wasting food).

The driver of sustainable behavior maintenance (i.e., a selected cultural practice) features the aggregate outcome of 20% average decrease in food waste in the same way a sustaining motivating operation mediates interdependent behavioral contingencies in the degree of a customer's environmental choices (Cesareo, 2018; Michael, 1982). The unit of analysis of macrobehavior or metacontingencies comprehend an (a) aggregate product (AP), resulting from (b) interlocking behavioral contingencies (IBCs) between the hotel restaurant and its guests, feeding a (c) receiving system (RS). These units shed light on the differences of a strategy for changing individual behaviors compared to a strategy for changing cultural practices generalized over situations and time. We illustrate and relate macrobehavior and metacontingencies to an alternative way of interpreting and upscaling this and possibly other nudging experiments according to a cultural selectionist model.

As long as the nudges are in place, it is clear that the behavioral output of food waste reduction should be retained. Acknowledging the success of this intervention, one question arises: What happens when the nudges are withdrawn? Will the organization and its customers maintain the reduction of food waste, or will they revert to baseline values? To establish a cultural practice that may last, contingencies must change from mere nudging – or macrocontingencies – to metacontingencies (i.e., coordinated group behavior). The definition of a cultural practice must include the necessary condition of survival over time, even though old members of the culture are replaced by new ones (Sandaker, 2009, p. 288).

For the analysis of learning, changing and maintaining behavior, our theoretical framework is the functional concept offered by operant conditioning. This tradition, however, is mostly concerned with individual behaviors. Sigrid Glenn (1986, 1988, 2003; 2016) defines

the contingencies responsible for the selection of cultural practices in terms of metacontingencies.

A metacontingency is the joint effect of interacting people (IBCs), their AP, and a RS. The IBCs are prerequisites for obtaining the AP, which could not be produced by the same individuals acting separately. The RS, the third component of the metacontingency, is responsible for the selection of the AP, and hence for the selection of the cultural practice. The concept of metacontingencies is different from *macrocontingencies* (Abreu Vasconcelos, 2013; Glenn, 1986, 1988; Glenn & Malott, 2006; Todorov, 2013; Ulman, 1998), in the sense that the AP of many people's behaviors may have societal impact (like paying taxes or quitting smoking), but there need not be any cooperation or IBCs. Figure 1 depicts a schematization of the main differences between a four-term behavioral contingency, a metacontingency and a macrocontingency, and where we consider nudges most effective.

In some sense, the nudging approach reflects macrocontingencies that prompt many people in various forms (whether they are taxpayers or smokers, etc.), in order to make more sensible choices for themselves and society. However, they do so independently of each other. We may talk about an AP both in the case of large-scale individual behavior change (i.e., macrobehavior) and in the case of coordinated (meta) behavioral efforts. These two processes are different insofar as the AP cannot be produced without a coordinated effort of individuals in a metacontingency (Glenn, 1986, 1988, 2003, 2004).

The consequence of one member of the culture or organization serves as the antecedent of another member. Individuals are responsible for the maintaining cultural practices, as a result of their cooperation, which is transmitted generation after generation. In the example above, both employees and customers are necessary in order to achieve the common result. They must coordinate, as any unidirectional effort does not fulfill the requirement of interdependency in the production of APs. Moreover, restaurant guests will

leave and new customer generations will continue to attend meals. If new behaviors are established by too few individuals, the practice is likely to die out with the individuals, without being transmitted further.

This work is grounded on the increasing production of empirical studies aimed at nudging large-scale behaviors, and their ambitious aims to create sustainable practices. We believe that the metacontingency scope may help to structure better-coordinated interventions, and achieve outcomes characterized by more longevity. The selectionist perspective suggests that consequences of behaviors – whether individual or the behavior of a group – influence the probability of the future recurrence of behaviors.

A nudge introduces stimulus control by mainly changing the antecedents of behaviors; a metacontingency brings the behaviors under control of a reinforcing event. The concept of metacontingency and the ongoing research on the selection of cultures offers a promising approach to understanding how cultural practices evolve, are maintained, or go extinct.

This perspective is in its infancy and will be refined and developed as best practices and experiments offer new insights. We hope to open a space for discussion of this idea to enhance further a multidisciplinary dialogue and to program green behaviors in our cultural repertoires. We aim to achieve enduring social changes in the cultural contingencies of behavior following the choice architects' departure from the field.

### **The need for a behavioral analytic systems perspective**

Behavioral systems analysis is the applied branch of behavior analysis concerned with organizational behavior management in complex systems. We discuss metacontingencies in the light of some founding concepts in systems analysis. They may be useful to define and analyze the role of feedback, and how selection and interdependency take place.

According to general systems theory, a system possesses three interdependent and fundamental properties (Parsons, 1951; Skyttner, 2005; Von Bertalanffy, 1968). This holds

true whether the system is social or not. The first property is the systems function, which depicts its relation to the environment. Similar to the metacontingency, external feedback loops that reaching outside the system comprise the relation between the AP and the RS.

The second property is the systems process, and it maintains the systems overall function. Parallel to the IBCs, the process of a system serves as a prerequisite for its overall functioning. The feedback from the RS (i.e., the environment) is the selecting unit for the maintenance or adjusting of the AP.

The third property is the systems structure. The metacontingency does not deem the structure responsible for the AP and for the relation to the environment.

We depict a representation of the model in Figure 2: it builds on the classic three-term metacontingency from Glenn and Malott (2006). The authors described metacontingencies in organizational settings, exemplified through the restaurant business: the work of interdependent colleagues (IBCs) leads to a culinary product (AP), which is received (or rejected) by a group of customers (RS).

Nonetheless, the model we put forward is different from Glenn and Malott's model in at least two regards. The first difference consists of including both employees and customers' IBCs in the first term, because the AP (reduced food waste) may only be achieved as the result of their cooperation. The second difference postulates that the RS is comprised of both an internal selector (e.g., business stakeholders), and an external selector (e.g., overarching policies), which feedback the IBCs (i.e., maintain cooperation).

Scholars adhering to an object of debate and further conceptual refinements in the selection of cultures perspective are further refining the conceptual framework. The debate concerns the unit of selection, and whether it is the IBCs or the resulting AP that are selected by the RS (e.g., Carvalho Couto & Sandaker, 2016; Couto de Carvalho & Sandaker, 2016; Houmanfar, Rodrigues, & Ward, 2010; Krispin, 2016).

If the answer were straightforward, we would be in the position of building a nudge catalogue that may be applicable with the same degree of efficacy across different cultures and organizations. Contrarily, nudges are not considered “silver bullets”. Their effectiveness seems to rely on social and cultural context. Contributions from behavior analysis and specifically its efforts into inducting universal laws of behavior from empirical work may overcome any variability in results by identifying the behavioral contingencies behind cross-cultural nudge studies.

Depending on the researcher’s scope of analysis, nudging interventions must remain flexible to meet the degree of interdependence between the contributors of the AP. A metacontingency analysis can help evaluate the durable effects of nudging on a large scale and contribute to better understanding and predicting large-scale behavior.

In addition to the benefits that a cultural level of analysis bears, the increase in complexity and terms also lead to some discussions that need be addressed. Firstly, metacontingency analyses are by definition group-level. The term *culturant* (Glenn et al., 2016) refers to phenomena capturing the selection of interaction between two or more people: “[t]he contingent relation, then, in a metacontingency is between a culturant (IBC+AP) and its selecting consequences” (p. 13).

The culturant is the counterpart of the *operant behavior* that comprises the unit of analysis at the individual level. It captures the role of the antecedents on learning with high technical precision. Interpreting the effects of nudging interventions through operant conditioning may comprise a satisfactory level of explanation as the data may be aggregated. Metacontingencies are able to capture the interactions and identify the IBCs. We need not refer to them in order to explain individual behavior. The control of behavior exerted by antecedents only is therefore more vulnerable to the changing contingencies, whereas the

cooperation resulting from the IBCs strengthen the contingencies and make the behavior more likely to occur.

There is no nudging study that claims its effectiveness based on single case design. The exposure of a single individual to an effective nudge may have a cumulative impact on group change and initiate the evolution of cultural practices through continuous exposure and learning. Without the component of interaction, the appropriate term for cumulative group behavioral contingencies would be *macrocontingencies*, which are not characterized by interlocks between the consequences of one and the antecedents of the other. The concept may still be useful, but our interpretations become less complex – and perhaps less desirable – if we leave the interaction out of the analysis.

This limitation in applicability comprises the primary strength of a metacontingency analysis, which provides thorough functional explanations of interdependent behavior. By extension, the reader might argue that any study of group behavior might be improved by a metacontingency analysis. The aim of such analysis would possibly consist in identifying the environmental contingencies that sustain the interaction between “nudger(s)” and those being nudged to maintain the positive outcomes of the intervention. We must therefore differentiate between cumulative behavior and the result of coordinated and cooperative behavior. We suggest introducing a metacontingency analysis only to the studies concerned with the latter.

Secondly, engaging in a system analysis can mean adding further (and unnecessary) complexity to the understanding of nudging and sustainable behavior. Research efforts are more demanding both in the behavioral mapping phase preceding the intervention while fragmenting the aggregate data after the experiment. For example, some of the most effective nudging interventions tackle individual choice behavior through default rules-setting, as in the case of voluntarily registering as an organ donor in opt-in countries versus opt-out countries



(Johnson & Goldstein, 2003). An analysis of the individual contingencies of reinforcement may suffice for interpreting the cumulative incidence of this instance of prosocial behavior.

Thirdly, the design of metacontingencies may not be adaptable enough to fit the heterogeneity of applied settings, with issues of retaining a strict degree of experimental control. For example, it is unclear from the original study whether the experimenters involved the staff of the hotel restaurant fist-handedly, or whether they interacted with the management only, in order to swap the plates and post the signage.

Lastly, we address the permissibility to programming positive consequences (or the threat of negative consequences) to reinforce nudged behavioral and cultural repertoires. In fact, introducing reinforcing consequences in order to sustain the effectiveness of the redesigned antecedents does not fit the scope of nudging. Nudges need not substantially change the (economic) incentives of alternative choice behavior (Thaler & Sunstein, 2008), but rather represent “means of bringing behavior under the control of wide and abstract reinforcer contingencies” (Rachlin, 2015, p.198).

In a subsequent paper, Cass Sunstein (2017) suggests this strategy in order to overcome the limits of nudges, when they do not seem to work. We argue that providing positive consequences to the behaviors exposed to nudges that already work would make them even more effective. In our example on food waste, this may mean rewarding cooperative behavior. Yet, as this manipulation programs changes in consequences that alter the incentive system, the issue deserves further clarifications through forthcoming studies

### **Conclusions**

The nudging experiment chosen to illustrate the model of cultural selection we put forward represents one example of designing a sustainable social architecture. Our analysis may be suitable for any other nudging study, in which the desired outcome is dependent upon the interconnection of individual behavioral contingencies.

Specifically, we suggest capitalizing on the degree of cooperation between supplier-consumer groups, in order to consolidate the acquisition of more functional and interdependent behavioral repertoires. Addressing these relationships through the metacontingency concept is a way to strengthen the sustainability of nudging interventions, by embedding them into cultural practices. Not only does it contribute to common environmental far-sighted goals, it may also have applications for health and welfare, shared economies, and social equality issues. The manipulation of contingencies to reduce food waste did not negatively affect the customers' meal experience, and may therefore have implications for a sustainable cultural practice. We stand to analyze choice behaviors by enhancing the effect of antecedents control with the effect of the selecting agent.

While nudging represents a powerful and non-invasive approach to changing individual human choice behaviors, the conceptual framework offered by a behavior analytic approach may inform the creation of more cooperative cultural practices. Showing environmentally responsible behavior is a responsibility we have towards the wellbeing of our planet and its limited resources. Sustainable solutions cannot be handled on an individual basis; they need be embedded in our social and cultural systems.

### **Compliance with ethical standards**

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**Conflict of interest:** the contents of this manuscript were first presented at the 8<sup>th</sup> Conference of the European Association for Behaviour Analysis hosted in Enna, Italy, on September 16, 2016. The authors declare that there is no conflict of interest.

**Ethical approval:** this article does not contain any studies with human participants or animals performed by any of the authors.

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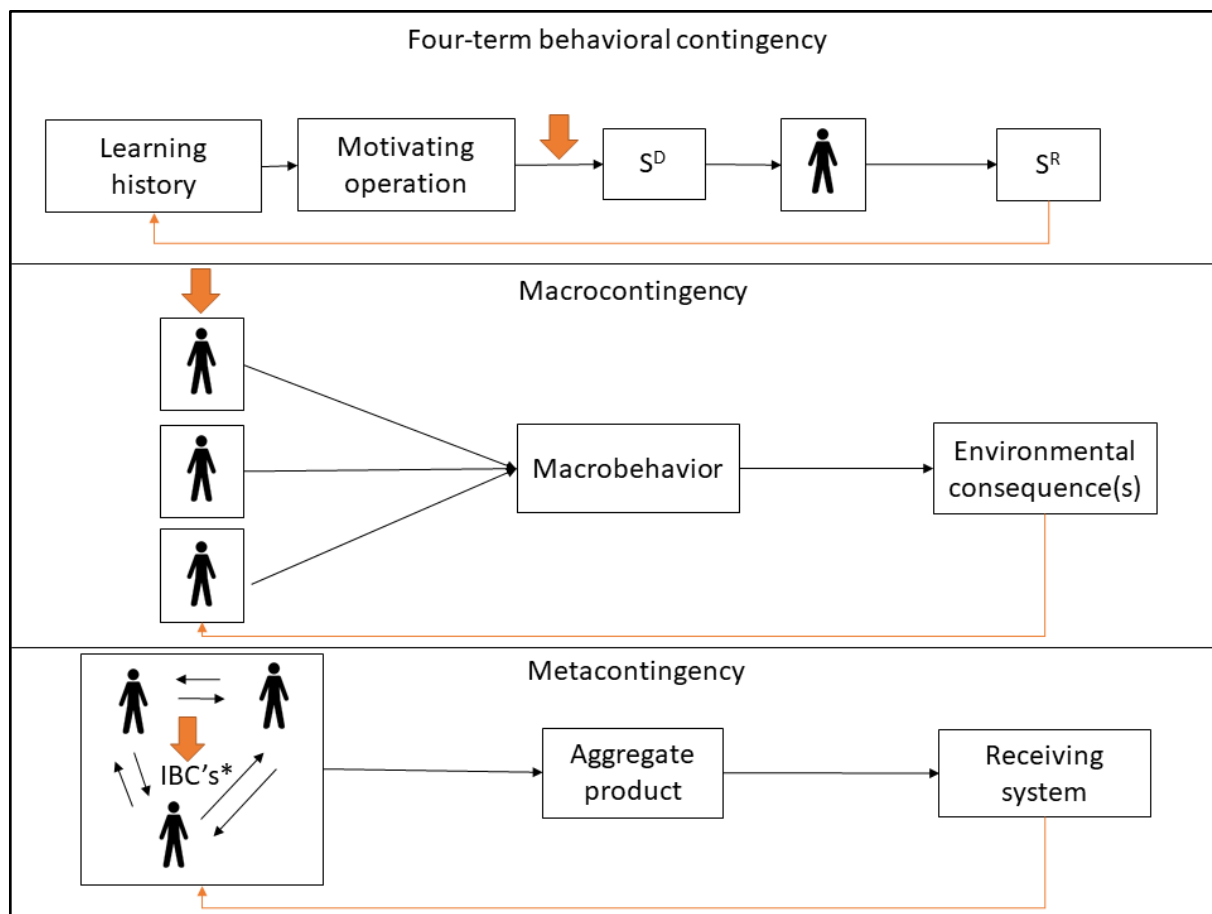
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Table 1

*Average amount of food waste (kg) per hotel in the control group (38 hotels) and test groups (7 hotels in each group), before and after the treatment was introduced. Standard deviations in brackets.*

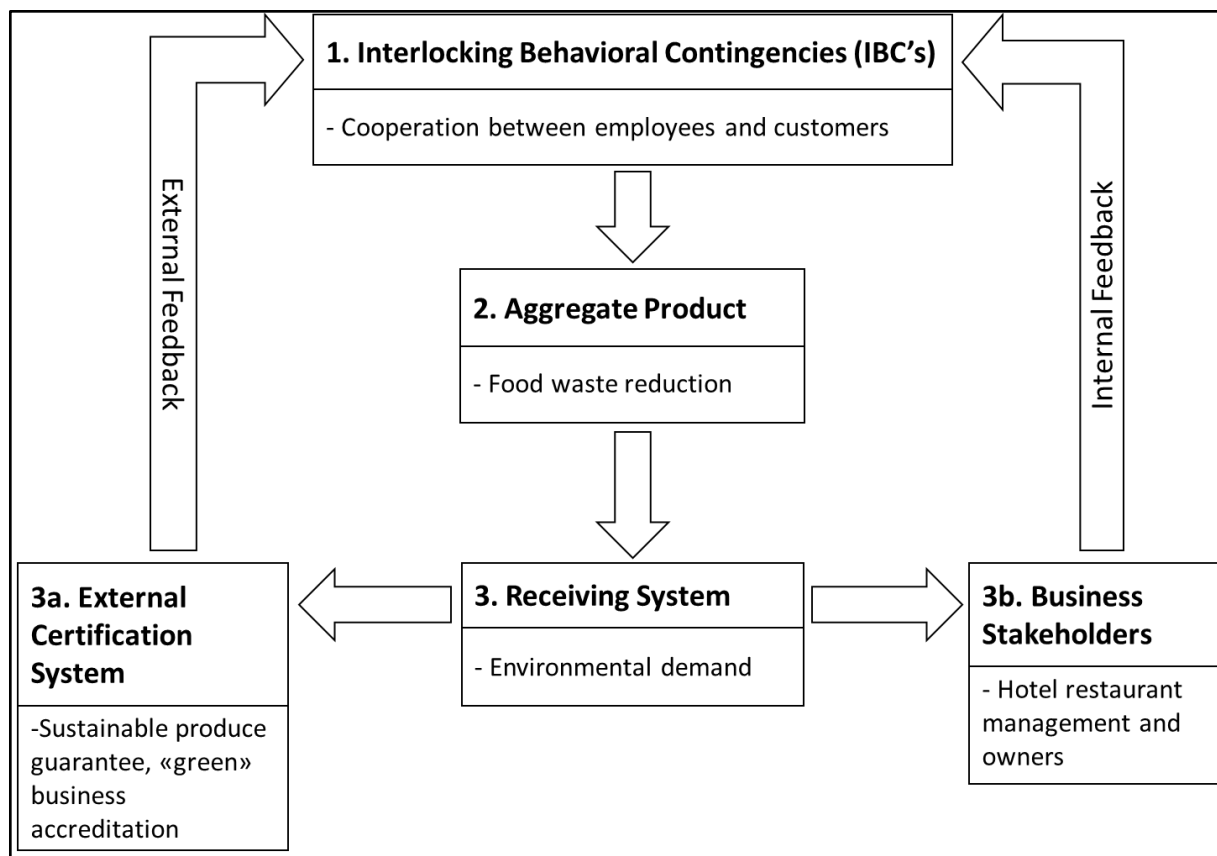
Group	Pre-treatment food waste (kg, average per hotel)	Post-treatment food waste (kg, average per hotel)
Control	35.07 (34.63)	32.98 (30.77)
Reduced plate size	36.88 (51.06)	25.84 (27.15)
Salient sign	47.76 (38.88)	34.25 (25.84)

*Note.* Reprinted from Economics Letters, 119(3), Kallbekken S.& Sælen S., ‘Nudging’ hotel guests to reduce food waste as a win-win environmental measure, Pages No. 325-327, Copyright (2013), with permission from Elsevier.



*Figure 1.* Differences between behavioral contingency, macrocontingency and metacontingency. The bold orange arrows represent where nudges intervene; the light orange arrows represent feedback loops.

\*Interlocking Behavioral Contingencies (IBC's)



*Figure 2.* Schematization of the metacontingency principle, in relation to the hotel restaurant example.