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Applying nudging techniques to promote fuel efficient car purchases

UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

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Swiss Federal Office of Energy SFOE
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CH-3003 Bern
www.bfe.admin.ch
energieforschung@bfe.admin.ch

Université de Genève
Consumer Decision and Sustainable Behavior Lab
Boulevard du Pont d'Arve 40, CH-1205, Genève
https://www.unige.ch/fapse/decisionlab/

Universität St.Gallen
Institut für Wirtschaft und Ökologie
Tigerbergstrasse 2, CH-9000, St.Gallen
http://www.iwoe.unisg.ch

Authors:
Mario Herberz, University of Geneva, mario.herberz@unige.ch
Jana Plananska, University of St.Gallen, jana.plananska@unisg.ch
Dr. Ulf Hahnel, University of Geneva, ulf.hahnel@unige.ch
Dr. Karoline Gamma, University of St.Gallen, karoline.gamma@unisg.ch
Prof. Dr. Tobias Brosch, University of Geneva, tobias.brosch@unige.ch
Prof. Dr. Rolf Wüstenhagen, University of St.Gallen, rolf.wuestenhagen@unisg.ch

SFOE head of domain: Dr. Anne-Kathrin Faust, Anne-Kathrin.Faust@bfe.admin.ch
SFOE programme manager: Dr. Yuliya Blondiau, Yuliya.blondiau@bfe.admin.ch
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Zusammenfassung

Um die schweizerischen Energie- und Klimaziele zu erfüllen, muss der Marktanteil von kraftstoffsparenden Fahrzeugen deutlich erhöht werden. Trotz des aktiven Engagements von Akteuren des öffentlichen und privaten Sektors zur Förderung des Absatzes solcher Fahrzeuge wächst ihr Bestand innerhalb der gesamten Schweizer Flotte nach wie vor nur langsam. Die derzeit umgesetzten Strategien zur Förderung kraftstoffsparender Fahrzeuge in der Schweiz müssen durch alternative Massnahmen ergänzt werden, um das Potenzial dieser neuen Technologien voll auszuschöpfen. Verhaltensbezogene Interventionen, insbesondere die als "Nudges" bezeichneten Techniken der Verhaltensarchitektur, können eine solche Option darstellen. Da sie sich als wirksam erwiesen haben, anderes umweltfreundliches Verhalten zu fördern, sollte das Wissen über ihre Wirksamkeit auch auf den Mobilitätssektor übertragen werden.

Ziel dieses Projekts war es, effektive "Nudging"-Techniken zu identifizieren und zu testen, um die Verbraucher zu motivieren, ihre Kaufentscheidungen auf kraftstoffsparende Fahrzeuge zu verlagern. Um dieses Ziel zu erreichen, analysierten wir im Rahmen dieses Projekts zunächst die Evidenz von "Nudging"-Interventionen in der Theorie (Top-down-Ansatz), einschliesslich ihrer Klassifizierung und Anwendung in verschiedenen Bereichen. Parallel dazu identifizierten wir die am häufigsten angewendeten Techniken zur Förderung kraftstoffeffizienter Mobilität in der Praxis (Bottom-up-Ansatz). Anschliessend kombinierten wir die durch beide Ansätze gewonnenen Erkenntnisse und identifizierten und entwickelten eine robustere Klassifikation der Nudging-Techniken, die als wirksam zur Förderung des Kaufs kraftstoffeffizienter Fahrzeuge in der Schweiz erachtet wurden. Wir testeten diese "Nudging"-Techniken mit Hilfe von Labor- und Online-Studien sowie einer mit einem Projektpartner durchgeführten Feldstudie. Darüber hinaus führten wir zwei zusätzliche Studien (Vorstudien) durch, in denen wir die Transportmotive und den Fahrzeugkaufprozess als solchen analysierten.

Die Ergebnisse des Projekts zeigen, dass die kraftstoffeffiziente Mobilität in der Schweiz zunimmt, wobei eine Vielzahl von Akteuren in das Feld eintritt und kraftstoffeffiziente Fahrzeuge mit einer Vielzahl von Massnahmen, einschliesslich "Nudging"-Interventionen, fördert. Darüber hinaus entwickelte das Projekt eine robustere Klassifikation der Nudging-Techniken, die auf Münscher, Vetter, and Scheuerle (2016) aufbaut, aber auf die Ziele des Projekts, d.h. den Bereich der privaten Elektromobilität, ausgerichtet ist. Die erste Vorstudie zeigte, dass der Fahrzeugkaufprozess aus fünf Phasen besteht und durch eine Vielzahl von Entscheidungsstrategien unterstrichen und von vielen externen Faktoren beeinflusst wird. Darüber hinaus identifizierte die Studie drei Berührungspunkte innerhalb der relevanten Stufen des Entscheidungsprozesses zur Förderung des Verkaufs von Elektrofahrzeugen, nämlich die Bereitstellung spezifischer Informationsquellen, Schulungsprogramme für Autohändler und Investitionen in die Ladeinfrastruktur. Die zweite Vorstudie zu Mobilitätsmotiven zeigte, dass der Kauf von kraftstoffeffizienten Fahrzeugen durch Umweltmotive motiviert ist, während Motive, die mit dem gesellschaftlichen Status zusammenhängen die Einführung umweltschädlicherer Autos vorantreiben. Die Studie hob auch die Rolle der Gewohnheiten für Mobilitätsentscheidungen hervor, wobei der Kauf von kraftstoffeffizienten Fahrzeugen weniger stark von Gewohnheiten getrieben zu sein scheint als der Kauf von anderen Mobilitätsoptionen (z.B. umweltschädlichere Autos oder öffentliche Verkehrsmittel).

Die Ergebnisse der im Rahmen des Projekts durchgeführten empirischen Studien haben sowohl theoretische als auch praktische Implikationen. Sie identifizieren und testen sechs "Nudging"-Interventionen als potenziell vielversprechend für die Förderung von energieeffizienten Fahrzeugen in der Schweiz: Bündelungstechniken, soziale Normen, Framing (Vergangenheit und Zukunft),

Kommunikation von Konsumeinheiten und die Aktivierung von Statusrollen. Bündelungstechniken sind eine sehr verbreitete Marketingstrategie, in der zwei und mehr Produkte zusammen in einem Paket verkauft werden. Die Strategie wurde in anderen Bereichen erfolgreich benutzt, um umweltfreundliches Verhalten zu fördern. Daher entschieden wir, die Strategie im Rahmen dieses Projektes zu testen. Die Bündelung von Elektroautos und Ladediensten (private Ladestation und ihre Installation, Zugang zum öffentlichen Ladenetzwerk und Ökostrom-Zertifikat) erweist sich als wirksam, um die Kaufbereitschaft der Schweizer Verbraucher zu fördern, insbesondere derjenigen, die nur über geringe Kenntnisse über Elektroautos verfügen. Die Onlinestudie mit 313 potentiellen Schweizer Autokäufern identifizierte drei Kundensegmente mit unterschiedlichen Bündelpräferenzen. Die Gruppe der Komfortorientierten reagierte am positivsten auf die Bündelung und war mit mehr als der Hälfte der Stichprobe gleichzeitig das grösste Kundensegment. Die Aktivierung sozialer Normen erweist sich ebenfalls als eine potenziell wirksame Nudgingstrategie. Normen müssen jedoch glaubwürdig kommuniziert werden; die soziale Norm von wachsenden Elektroautoverkäufen sollte so kommuniziert werden, dass sie die Vorteile von Elektroautos hervorhebt. Der Framing Nudge zeigte eine höhere Unterstützung für die staatliche Förderung von Elektromobilität, wenn Elektromobilität als schon etwas in der Vergangenheit Dagewesenes kommuniziert wird. Dieser Effekt wurde verstärkt, wenn der Nudge von einer politisch eher konservativen Partei kam und hatte einen stärkeren Einfluss auf politisch konservativ eingestellte Personen. Schließlich zeigten die Studien zur Kommunikation des Verbrauchs von alternativen Antriebstechnologien (z.B. auf dem Schweizer Energielabel), dass die Wahl der Verbrauchseinheit einen signifikanten Einfluss auf die Wahrnehmung des Umweltprofils von kraftstoffsparenden Fahrzeugen haben kann. Konkret wurden kraftstoffsparende Fahrzeuge dann besonders umweltfreundlich bewertet, wenn ihr Verbrauch (z.B. kWh Energie) in ein Bezinäquivalent (Liter pro 100 km) übersetzt wurde. Darauf aufbauend zeigte eine weitere Studie, dass eine Rangeinheit, die den Verbrauch eines Fahrzeugs innerhalb aller derzeit auf dem Markt erhältlichen Autos positioniert, die höchste positive Auswirkung auf die Umweltbewertungen von kraftstoffsparenden Fahrzeugen hat.

Diese Ergebnisse führen zu sechs Empfehlungen für Schweizer politische Entscheidungsträger und Industrieakteure zur Förderung des Verkaufs von kraftstoffsparenden Fahrzeugen:

1. Gezielte Massnahmen in Bezug auf bestimmte Phasen im Fahrzeugkaufprozess und klar definierte Zielgruppen.
2. Den Verbrauch aller Fahrzeuge, auch Elektro- und Plug-in-Hybride, in Form eines Benzinäquivalents (Liter pro 100 km) kommunizieren, um das Verständnis der Konsumenten zu verbessern und die Vergleichbarkeit zu erleichtern.
3. Die Verwendung einer Rangeinheit, die den Verbrauch eines Fahrzeugs in den Vergleich zu allen anderen verfügbaren Fahrzeugen auf dem Markt stellt.
4. Die Schaffung einer zentralen Anlaufstelle für die Bereitstellung glaubwürdiger Informationen zur Elektromobilität für die Verbraucher (einschließlich aller Subventionsprogramme, Fahrzeugkonfiguratoren usw.).
5. Ausbildungsprogramme für Autohändler zum Verkauf von Elektrofahrzeugen.
6. Das regelmäßige Informieren über den zunehmenden Verkauf von Elektrofahrzeugen, vorzugsweise über soziale Medien.

Das vorliegende Forschungsprojekt zeigt, dass "Nudging"-Techniken eine wirksame Ergänzung zu den derzeitig implementierten Massnahmen sein können, um Anreize für den Kauf von kraftstoffsparenden Fahrzeugen in der Schweiz zu schaffen. Indem sie sowohl an emotionale als auch an rationale Triebkräfte des menschlichen Verhaltens ansetzen, können sie die Fülle von

Massnahmen, die den politischen Entscheidungsträgern in der Schweiz zur Verfügung stehen, signifikant erweitern. In den hier präsentierten empirischen Studien wurde die Wirkung einer Reihe von Nudging Interventionen systematisch getestet und validiert. Wie unser Feldtest jedoch gezeigt hat, können in der Praxis eine Vielzahl von Faktoren und unerwarteten Ereignissen auftreten, welche die Wirksamkeit der identifizierten Interventionen beeinträchtigen können. Folglich empfehlen wir den politischen Entscheidungsträgern in der Schweiz, randomisierte kontrollierte Feldstudien durchzuführen und die beobachteten Effekte aus Labor- und Online-Studien vor der Durchführung einzelner Interventionen in größerem Maßstab zu testen. Politische Entscheidungsträger können mit Forschern und anderen Experten zusammenarbeiten, welche die gewählten Interventionen bei einer ausgewählten Zielgruppe in der Praxis testen und evaluieren, z. B. mit Hilfe von experimentellen Studien, Befragungen oder Fokusgruppen. Unterschiedliche Versionen der Interventionen können dabei getestet werden, um Wirksamkeiten miteinander zu vergleichen. Politische Entscheidungsträger und weiterführende Forschung sollte auch die kombinierte Wirkung von mehreren Nudging Interventionen und deren Auswirkungen auf bestimmte Kundensegmente, die über die vorliegenden Erkenntnisse hinaus gehen, analysieren.

Résumé

Afin d'atteindre les objectifs énergétiques et climatiques de la Suisse, la part de marché des véhicules à faible consommation de carburant doit être considérablement augmentée. Malgré l'engagement actif des acteurs des secteurs public et privé pour promouvoir leurs ventes, leur stock au sein de l'ensemble de la flotte suisse ne continue de croître que lentement. Les stratégies actuellement mises en œuvre pour promouvoir les véhicules économes en carburant en Suisse doivent être complétées par des mesures alternatives afin d'exploiter pleinement le potentiel de ces nouvelles technologies. Les interventions comportementales, en particulier les techniques d'architecture comportementale connues sous le nom de "nudges", peuvent être une de ces options. Étant donné qu'ils se sont avérés efficaces pour promouvoir d'autres comportements respectueux de l'environnement, les connaissances sur leur efficacité devraient également être transférées au secteur de la mobilité.

Le but de ce projet était d'identifier et de tester des techniques efficaces de nudging pour motiver les consommateurs à orienter leurs décisions d'achat vers des véhicules économes en carburant. Pour atteindre cet objectif, nous avons tout d'abord analysé les preuves d'interventions de "nudging" en théorie (approche descendante), y compris leur classification et leur application dans différents secteurs. En parallèle, nous avons identifié les techniques les plus couramment utilisées pour promouvoir une mobilité économe en carburant dans la pratique (approche ascendante). Nous avons ensuite combiné les connaissances acquises grâce aux deux approches et avons identifié et développé une classification plus solide des techniques de nudging qui étaient considérées comme efficaces pour promouvoir l'achat de véhicules à faible consommation de carburant en Suisse. Nous avons testé ces techniques de nudging par des études en laboratoire et en ligne et une étude de terrain menée avec un partenaire de l'industrie. Nous avons également mené deux autres études dans lesquelles nous avons analysé les motifs de transport et le processus d'achat des véhicules en tant que tel.

Les résultats du projet montrent que la mobilité économe en carburant est en augmentation en Suisse, avec l'arrivée de divers acteurs sur le terrain et la promotion de véhicules économes en carburant par le biais de diverses mesures, y compris des interventions de type nudging. En outre, le projet a mis au point une classification plus robuste des techniques de nudging, basée sur Münscher et al. (2016), mais axée sur les objectifs du projet, c'est-à-dire le domaine de la mobilité électrique privée. La première étude préliminaire a montré que le processus d'achat d'un véhicule comporte cinq phases et est souligné par diverses stratégies de décision et influencé par de nombreux facteurs externes. En outre, l'étude a identifié trois points de contact dans les étapes pertinentes du processus décisionnel pour promouvoir la vente de véhicules électriques, à savoir la mise à disposition de sources d'information spécifiques, les programmes de formation pour les concessionnaires automobiles et les investissements dans les infrastructures de recharge. La deuxième étude préliminaire sur les motifs de mobilité a montré que l'achat de véhicules économes en carburant est motivé par des motifs environnementaux, tandis que des motifs liés au statut social entraînent l'introduction de voitures plus écologiques. Elle a également souligné le rôle des habitudes dans les décisions de mobilité, l'achat de véhicules à faible consommation de carburant semblant être moins dicté par les habitudes que l'achat d'autres options de mobilité (par exemple, des voitures plus polluantes ou les transports publics).

Les résultats des études empiriques menées dans le cadre du projet ont des implications à la fois théoriques et pratiques. Ils identifient et testent six interventions de nudging potentiellement prometteuses pour la promotion de l'achat de voitures électriques en Suisse - techniques de regroupement, normes sociales, cadrage (passé et futur), communication des unités de consommation et activation des rôles de statut. Les techniques de regroupement, l'achat d'un ou

davantage de produits dans un ensemble, sont les stratégies de marketing les plus populaires. Elles ont été appliquées avec succès pour promouvoir un comportement pro-environnemental dans d'autres domaines. Cela nous a conduit à tester une de ces stratégies dans le projet présent. Le regroupement des voitures électriques et des services de recharge (borne de recharge privé et son installation, accès au réseau de recharge public et certificat d'électricité verte) s'avère efficace pour promouvoir la volonté d'achat des consommateurs suisses, en particulier ceux qui ont peu de connaissances sur les voitures électriques. L'étude avec 313 clients suisses a également identifié trois segments avec des préférences de regroupement différents. Le segment des adoptants axés sur la commodité réagit le plus positivement au regroupement. Ce segment est aussi le plus grand, représentant plus de la moitié de l'échantillon. L'activation des normes sociales s'avère également être une stratégie potentiellement efficace pour donner des coups de pouce. Cependant, les normes doivent être communiquées de manière crédible ; la norme sociale de la croissance des ventes de voitures électriques doit être communiquée de manière à mettre en évidence les avantages des voitures électriques. Le cadrage nudge a montré un niveau de soutien plus élevé pour le financement public de la mobilité électrique si celle-ci était présentée comme ayant déjà existé dans le passé. Cet effet était plus fort chez les personnes politiquement plus conservatrices et si la source du message était un parti politique plus conservateur. Enfin, les études sur la communication de la consommation des technologies d'entraînement alternatives (par exemple sur l'étiquette énergétique suisse) ont montré que le choix de l'unité de consommation peut avoir une influence significative sur la perception du profil environnemental des véhicules à faible consommation de carburant. Plus précisément, les véhicules à faible consommation de carburant ont été classés comme particulièrement respectueux de l'environnement si leur consommation (par exemple en kWh d'énergie) était traduite en équivalent essence (litres sur 100 km). Sur cette base, une autre étude a montré qu'une unité d'autonomie qui positionne la consommation d'un véhicule parmi toutes les voitures actuellement disponibles sur le marché a l'effet positif le plus important sur les notes environnementales des véhicules à faible consommation de carburant.

Ces résultats conduisent à six recommandations pour les responsables politiques et les acteurs industriels suisses afin de promouvoir la vente de véhicules à faible consommation de carburant :

1. Des mesures ciblées relatives à des phases spécifiques du processus d'achat de véhicules et à des groupes cibles clairement définis.
2. Communiquer la consommation de tous les véhicules, y compris les véhicules électriques et hybrides rechargeables, sous la forme d'un équivalent essence (litres sur 100 km) pour améliorer la compréhension des consommateurs et faciliter la comparabilité.
3. Utiliser une unité d'autonomie qui permet de comparer la consommation d'un véhicule à celle de tous les autres véhicules disponibles sur le marché.
4. La création d'un guichet unique pour fournir aux consommateurs des informations crédibles sur la mobilité électrique (y compris tous les régimes de subvention, les configurateurs de véhicules, etc.)
5. Des programmes de formation pour les concessionnaires automobiles à la vente de véhicules électriques.
6. Fournir des informations régulières sur la vente croissante de véhicules électriques, de préférence par le biais des médias sociaux.

Le présent projet de recherche montre que les techniques de nudging peuvent être un complément efficace aux mesures actuellement mises en œuvre pour créer des incitations à l'achat de véhicules économes en carburant en Suisse. En s'attaquant aux moteurs émotionnels et rationnels du comportement humain, ils peuvent élargir considérablement la gamme de mesures dont disposent les décideurs politiques en Suisse. Dans les études empiriques présentées ici, les effets d'un certain

nombre d'interventions de nudging ont été systématiquement testés et validés. Toutefois, comme l'a montré notre test sur le terrain, dans la pratique, divers facteurs et événements inattendus peuvent se produire et nuire à l'efficacité des interventions identifiées. Par conséquent, nous recommandons aux décideurs politiques en Suisse de mener des études de terrain contrôlées et randomisées et de tester les effets observés à partir d'études en laboratoire et en ligne à plus grande échelle avant de mettre en œuvre des interventions individuelles. Les décideurs politiques peuvent collaborer avec des chercheurs et d'autres experts qui pourraient tester et évaluer les interventions choisies sur le terrain sur un groupe cible choisi, par exemple au moyen d'une étude expérimentale, d'une enquête de suivi ou d'un groupe de discussion. Plusieurs versions d'une intervention similaire peuvent être testées afin d'identifier leur efficacité différenciée. Les décideurs politiques et les recherches futures devraient également prendre en compte les effets combinés de multiples interventions de nudging et leur impact sur des segments de clientèle spécifiques au-delà de l'évidence fourni par le travail présent.

Summary

To meet Switzerland's energy and climate targets, the market share of fuel-efficient vehicles must be significantly increased. Despite the active commitment of public and private sector stakeholders to promote their sales, their stock within the entire Swiss fleet continues to grow only slowly. The strategies currently implemented to promote fuel-efficient vehicles in Switzerland must be supplemented by alternative measures in order to fully exploit the potential of these new technologies. Behavioural interventions, in particular the techniques of behavioural architecture known as "nudges", can be one of such options. Since they have proven to be effective in promoting other environmentally friendly behaviours, knowledge about their effectiveness should also be transferred to the mobility sector.

The aim of this project was to identify and test effective "nudging" techniques to motivate consumers to shift their purchasing decisions to fuel-efficient vehicles. To achieve this goal, we first analysed the evidence of "nudging" interventions in theory (top-down approach), including their classification and application in different sectors. In parallel, we identified the most commonly used techniques to promote fuel-efficient mobility in practice (bottom-up approach). Subsequently, we combined the insights gained by both approaches and identified and developed a more robust classification of nudging techniques that were considered effective in promoting the purchase of fuel-efficient vehicles in Switzerland. We tested these "nudging" techniques through laboratory and online studies and a field study conducted with a project partner. In addition, we conducted two supplementary studies (preliminary studies) in which we analysed the transport motives and the vehicle purchase process as such.

The results of the project show that fuel-efficient mobility is increasing in Switzerland, with a plurality of actors entering the field and promoting fuel-efficient vehicles through a variety of measures, including "nudging" interventions. In addition, the project developed a more robust classification of nudging techniques based on the research by Münscher et al. (2016) with a specific focus on the objectives of the project, i.e. the field of private electric mobility. The first preliminary study showed that the vehicle purchase process consists of five stages and is underpinned by a variety of decision-making strategies and influenced by many external factors. In addition, the study identified three points of contact within the relevant stages of the decision-making process to promote the sale of electric vehicles, namely the provision of specific information sources, training programs for car dealers and investments in charging infrastructure. The second preliminary study on mobility motives showed that the purchase of fuel-efficient vehicles is motivated by environmental motives, while motives related to social status drive the introduction of more environmentally harmful cars. She also highlighted the role of habits in mobility decisions, with the purchase of fuel-efficient vehicles appearing to be less driven by habits than the purchase of other mobility options (e.g., more polluting cars or public transport).

The results of the empirical studies conducted in the project have both theoretical and practical implications. They identify and test six "nudging" interventions as potentially promising for the promotion of electric car purchases in Switzerland: bundling techniques, social norms, framing (past and future), communication of consumption units and the activation of status roles. Bundling, the sale of two or more products in one package, is a very common marketing strategy. It has been successfully used to promote other types of pro-environmental behaviour and thus we decided to test a version of it in the present project. The bundling of electric cars (EV) and charging services (private charging station and its installation, access to the public charging network and green electricity certificate) has proven to be effective in promoting EV purchase willingness among Swiss consumers, especially those with limited knowledge about electric cars. The online study with 313 potentially interested Swiss customers identified three customer segments with different bundle preferences. The

convenience-oriented adopters, the segment that reacts the most positively to the bundle, is the largest one of them, accounting for more than half of the sample. The activation of social norms is also proving to be a potentially effective nudging strategy. Norms must be credibly communicated, however; the social norm of growing electric car sales should be communicated in a way that emphasizes the benefits of electric cars. The Framing nudge led to a higher level of support for state funding of electric mobility when electric mobility was communicated as having already existed in the past. This effect was stronger for politically more conservative people and if the source of the message was a more conservative political party. Finally, studies on the communication of the consumption of alternative drive technologies (e.g., on the Swiss energy label) showed that the choice of the consumption unit can have a significant influence on the perception of the environmental profile of fuel-efficient vehicles. Specifically, fuel-efficient vehicles were rated particularly environmentally friendly if their consumption (e.g., kWh energy) was translated into a gasoline equivalent (litres per 100 km). Based on this finding, a further study showed that a range unit that positions the consumption of a vehicle within all cars currently available on the market has the highest positive effect on the environmental ratings of fuel-efficient vehicles.

These results lead to six recommendations for Swiss policy makers and industry players to promote the sales of fuel-efficient vehicles:

1. Target the measures with regard to specific stages in the vehicle purchase process and clearly defined target groups.
2. Communicate the fuel consumption of all vehicles, including electric and plug-in hybrids, in the form of a fuel equivalent (litres per 100 km) to improve consumer understanding and facilitate comparability.
3. Use a range unit that puts the consumption of a vehicle in comparison with all other available vehicles on the market.
4. Create a one-stop shop for providing consumers with credible information on electric mobility (including all subsidy programs, vehicle configurators, etc.).
5. Deliver training programs for car dealers to sell electric vehicles.
6. Provide regular information on the increasing sales of electric vehicles, preferably through social media.

The present research project shows that "nudging" techniques can be an effective complement to the measures currently implemented to create incentives for the purchase of fuel-efficient vehicles in Switzerland. By addressing both emotional and rational drivers of human behaviour, they can significantly expand the range of measures available to policy makers in Switzerland. In the empirical studies presented here, the impact of a number of nudging interventions has been systematically tested and validated. However, as our field study has shown, a variety of factors and unexpected events can occur in practice that can impair the effectiveness of the identified interventions. Consequently, we recommend that policy makers in Switzerland conduct randomized controlled field studies and test the observed effects from laboratory and online studies on a larger scale before implementing specific interventions. Policy makers can collaborate with researchers and other experts who could test and evaluate the chosen interventions in practice on a selected target, for example by means of an experimental study, a survey or a focus group. Multiple versions of the similar intervention can be tested to identify their differentiated effectiveness. Swiss policy makers and further research can also analyse the combined effect of a multitude of nudges at once and their impact vis-à-vis specific customer segments beyond the present findings.

Main findings

- Nudging techniques are powerful complementary measures to promote sales of fuel-efficient vehicles in Switzerland.
- Identification of six most promising nudging techniques, i.e., bundling techniques, social norms, framing (past and future), communication of consumption units and the activation of status roles.
- Implications for theory and six recommendations for Swiss policy makers, how to more effectively promote fuel-efficient vehicles in Switzerland.

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Abbreviations

ASTRA	Federal Roads Office
CO_2	Carbon dioxide
CREST	Competence Center for Research in Energy, Society, and Transition
EV	Electric vehicle
ICE	Internal combustion engine vehicle
IEA	International energy agency
km	Kilometers
PHEV	Plug-in hybrid electric vehicle
SFOE	Swiss Federal Office of Energy
SUV	Sports-Utility vehicle
UNIGE	University of Geneva
UNISG	University of St.Gallen
UVEK	Federal Department of the Environment, Transport, Energy and Communications

1. Introduction

1.1. Project background

Private transportation is one of the main contributors to carbon dioxide (CO_2) emissions in Switzerland and the world, representing approximately 50% of transport sector emissions (Boulouchos et al., 2017; IEA, 2020a, 2020c). The adoption of more fuel-efficient vehicles is thus imperative to substantially reduce sector's environmental impact and to reach global energy and climate goals. Changing to battery electric vehicles (EVs) or plug-in hybrid electric vehicles (PHEVs) has a particular high potential, especially if matched with electricity generated from renewable sources of energy (Boulouchos et al., 2017; Miotti, Supran, Kim, & Trancik, 2016).

Public administration and industry increasingly embrace the promotion of fuel-efficient vehicles, especially EVs and PHEVs. Policy makers worldwide have implemented a large number of interventions, ranging from emission regulation and financial incentives to soft policy tools such as information campaigns (Brown Jr, 2018; Holtsmark & Skonhoft, 2014; Lieven, 2015; UVEK, BFE, & ASTRA, 2018). Industry is also increasingly active in the sector, with a growing number of models entering the market, active development of the charging infrastructure and marketing presence (Ionity, 2020; McKerracher, Izadi-Najafabadi, O'Donovan, & Albanese, 2020; Plug'nRoll, 2020b). Despite this active engagement, the market share of EVs and PHEVs remains with 2.6% globally and 9.7% in Switzerland in 2019 relatively low, leaving the potential of the private transportation sector to contribute to climate objectives untapped (BFS, 2020; IEA, 2020b).

One of the reasons for the lacking capacity of traditional policy measures and industry activities to motivate adoption of fuel-efficient vehicles is that their majority targets rational factors of consumer decisions, such as financial subsidies that are aimed to change cost-benefit considerations of a car purchase (Lieven, 2015). However, driving and purchasing a car has shown to be influenced by a multitude of psychological and cultural factors, such as emotions, habits and social norms (Scharff, 1992; Steg, 2005; Urry, 2004). Consequently, policy makers should attempt to complement the traditional policy interventions by alternative measures that consider the complexity of human decision making (McCollum, Wilson, Bevione, & al., 2018; Rezvani, Jansson, & Bodin, 2015).

Behavioural policy strategies that are informed by the understanding of the underlying psychological factors that drive consumer decisions offer one of such options. Prominent among them have become *nudges* and the concept of choice architecture (Thaler & Sunstein, 2008). Nudges have shown to yield quite significant effects to promote pro-environmental behaviour in other domains. They have proven effective to increase in-home energy savings, subscription to renewable energy tariffs, and the reuse of towels by hotel guests, among others (Allcott & Kessler, 2019; Bohner & Schlüter, 2014; Chassot, Wüstenhagen, Fahr, & Graf, 2017). Typically, nudging interventions have the advantage of yielding immediate effects at relatively low costs, while preserving consumers' freedom of choice and not altering economic incentives (Benartzi et al., 2017; Sunstein, 2014; Thaler & Sunstein, 2008). Additionally, their freedom-preserving nature should make nudges more socially acceptable than traditional policy approaches such as regulation or mandates since they do not restrict the freedom of choice of individuals (Reisch & Sunstein, 2016). In the field of consumer preference and adoption of fuel-efficient vehicles, the understanding of psychological processes and the application of nudging

interventions is less advanced. For instance, one successful nudging intervention observed that general consumer preferences for electric vehicles increase once the consumer has experienced driving an electric vehicle first-hand (Bühler, Cocron, Neumann, Franke, & Krems, 2014). More systematic and domain-specific research is however needed to untap the potential of nudging techniques within the car sector.

1.2. Theoretical foundations

A nudge, as defined by Thaler and Sunstein (2008), is "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Ibid., p. 6). Choice architecture interventions have since then flourished, leading to a plurality of categorisations of taxonomies. One of the most complete conceptualization has been developed by Münscher et al. (2016), that classify the choice architecture techniques in three main categories and nine intervention techniques, as seen in Table 1 below.

Table 1: Choice architecture categories and techniques *(Münscher, Vetter & Scheuerle, 2016, p. 514).*

Category	Technique
A. Decision information	A 1 Translate information *Includes: reframe, simplify* A 2 Make information visible *Includes: make own behavior visible (feedback), make external information visible* A 3 Provide social reference point *Includes: refer to descriptive norm, refer to opinion leader*
B. Decision structure	B 1 Change choice defaults *Includes: set no-action default, use prompted choice* B 2 Change option-related effort *Includes: increase/decrease physical/ financial effort* B 3 Change range or composition of options *Includes: change categories, change grouping of options* B 4 Change option consequences *Includes: connect decision to benefit/cost, change social consequences of the decision*
C. Decision assistance	C 1 Provide reminders C 2 Facilitate commitment *Includes: support self-commitment/public commitment*

Each type of nudging intervention aims at influencing a specific aspect of the consumer decision process. Decision information nudges target the way in which choice options are described, decision structure nudges influence the way in which choice options are organized and structured, and decision assistance nudges target the way in which decisions can be reinforced. In the following we describe the three choice architecture intervention techniques in more detail.

1.2.1. Decision information nudges

Decision information nudges are rooted in behavioural research showing that individual decisions are largely affected by the way in which choice alternatives are described (Johnson et al., 2012). Decision makers have the tendency to base their decisions mainly on information that is directly available to them in the very decision situation (Kahneman, 2011; Slovic, 1972), while ignoring information that is too complex or not salient to them (Hsee & Zhang, 2010; Shah & Oppenheimer, 2008). Decision information nudges aim to enhance decision making by increasing the availability, comprehensibility, and relevance of the communicated information.

One prominent example of this choice architecture technique is social norms. For instance, providing households regularly with information comparing their own energy consumption to that of their neighbours reduced household electricity consumption by an average of 2% (Allcott, 2011). This effect was approximately equivalent to a short-term electricity price increase from 11 to 20%. Other decision information nudges reveal information to the decision maker that would otherwise stay invisible, such as CO_2 emissions through energy labels (Roberto, Larsen, Agnew, Baik, & Brownell, 2010) or energy consumption through feedback devices (Jessoe & Rapson, 2014). Additionally, translating descriptions of choice attributes so that they become more intuitively evaluable to the consumer by simplification or reframing can be likewise categorized as a decision information nudge (Larrick & Soll, 2008).

1.2.2. Decision structure nudges

Decision structure nudges aim to influence behaviour through the arrangement of choice options. By changing the composition of a choice set, the order of choice options, or the introduction of a pre-selected choice, important behavioural changes can be instigated. (Bucher et al., 2016; Garnett, Balmford, Sandbrook, Pilling, & Marteau, 2019). Decision makers have been shown to prefer choice options that stick out as more prominent, because of simple inertia or because the highlighted option is perceived as a decision recommendation (Carroll, Samek, & Zepeda, 2018; Chassot et al., 2017). One prominent example of this nudge intervention is the pre-selection of an option that will be assigned to the decision maker if they do not actively decide differently, known as *choice defaults*. In a study comparing organ donation policies in European countries, the authors found that the share of organ donors was much higher in countries where individuals were by default registered as organ donors compared to countries where individuals had to actively take the decision to “opt-in”, to register as donors (Johnson & Goldstein, 2003). The introduction of being organ donors by default was estimated to result in an increase of organ donations by 16.3%. Other decision structure nudges change the effort related to choose a given option, for instance by changing the range and composition of options (Martin & Norton, 2009) or by creating convenient bundles of products (Carroll et al., 2018).

1.2.3. Decision assistance nudges

Decision assistance nudges aim to facilitate the implementation of behaviour that people have committed to beforehand or that is in line with their values and aspirations. Thereby, the prevalent gap between intention and behaviour can be bridged by facilitating self-regulation (Sheeran et al., 2018). One example of this nudge type are commitment devices, which are designed to remove psychological barriers such as procrastination that often impede the successful implementation of desired behaviour (Lillemo, 2014; Thaler & Benartzi, 2004). In a study where employees committed to allocate parts of their future salaries to retirement savings, commitment increased average saving rates from 3.5% to 13.6%. Another example of decision assistance nudges are priming interventions

and framing which activate a subset of the consumers' values and motives and guides them to decisions that are more in line with these values and motives (Mertens, Hahnel, & Brosch, 2020; North, Sheridan, & Areni, 2016).

1.3. Preliminary studies

The mobility sector, and especially private vehicles have seen important developments and innovations in the past years. We thus considered it to be beneficial to run two preliminary studies to update and enrich our knowledge base and provide us with a point of departure on which to develop the nudging interventions to be tested in the present project. Specifically, we investigated consumer motivations in the context of low-carbon mobility and the vehicle purchase process to identify touchpoints for nudging interventions to promote purchases of electric vehicles. The details on their methodology, main results and findings are presented in the sections 3.1 and 3.2, respectively.

1.4. Purpose of the project

The goal of this project is to provide information to Swiss policy makers how nudging can be effectively leveraged to promote purchases of fuel-efficient vehicles in Switzerland. To achieve that, multiple steps are necessary. The theoretical background outlined above showed that there is a large number of nudging interventions implemented in theory and practice. Yet, its application and understanding relative to the mobility sector is less advanced. Consequently, we firstly aimed to enlarge this theoretical understanding of nudging including their various classification schemes and implementation in different fields with the focus on pro-environmental behaviour (what we further call the *top-down approach*). In parallel we also identified the nudges implemented by policy, industry and the non-profit sector in the transport sector to motivate fuel-efficient vehicle purchases in practice (*bottom-up approach*). These two approaches were then combined, classifying and evaluating the nudges identified in both practice and academia and analysing them in view of the feasibility and potential to leverage the adoption of fuel-efficient vehicles in Switzerland. The pre-identified nudging interventions were then empirically tested by the means of laboratory and online studies and a field study with a project partner. The findings provided needed insights based on which recommendations for Swiss policy makers how to more effectively promote fuel-efficient vehicles in Switzerland can be made.

1.5. Objectives

The objectives of the present project are following:

1. Understanding the private mobility sector in Switzerland, including consumer mobility motives and vehicle purchase process.
2. Analysing nudging interventions in theory, including different classification schemes and application in different fields.
3. Identifying the most promising nudging techniques implemented in practice to promote (by policy, industry and non-profit sector).
4. Classifying and evaluating the identified nudges for the purposes of the project.
5. Selecting the most promising nudging interventions.

6. Empirically investigating the selected nudges by means of laboratory, online studies and a field study.
7. Extrapolating the gained insights to provide recommendations for Swiss policy makers to promote purchases of fuel-efficient vehicles in Switzerland.

2. Procedures and methodology

The research methodology of the present project simultaneously applied a top-down and a bottom-up approach to identify the nudges that can be leveraged to promote fuel-efficient vehicle purchases. The top-down approach aimed to develop new nudges based on an extensive review of contributions from the fields of psychology and behavioural economics, mainly reviewing applications of nudges in the related fields of pro-environmental behaviour such as the uptake of renewable energy and sustainable lifestyles. The goal of the bottom-up approach was to identify and improve the existing nudges applied in the transport sector by a wide plurality of actors. With this dual pathway strategy, the aim was to identify a maximum of promising nudges to promote fuel-efficient car purchases, and in a second step to test the effectiveness of the ones selected by the team as potentially the most effective.

2.1. Top-down approach: Meta-analysis of nudging interventions in the literature

More than a decade of scientific research on nudging interventions has accumulated since the concept of *nudging* became popular in 2008 (Thaler & Sunstein, 2008). In many singular studies the effectiveness of nudging interventions has been demonstrated in various domains (Allcott, 2011; Thaler & Benartzi, 2004). However, a systematic assessment of the effectiveness of existing nudging interventions across domains and nudging techniques is missing until present. As part of the present project we aimed to provide an overall assessment of the effectiveness of nudging interventions in form of a meta-analysis. The approach of a meta-analysis was chosen to allow for a quantitative comparison of the effectiveness of different nudging techniques (Münscher et al., 2016) across different domains. The analysis was expected to provide insights into which nudging techniques are most promising to be transferred from other domains to the domain of fuel-efficient car adoption, where applications of nudging interventions are still scarce.

We identified a total of 214 research articles that investigated nudging interventions and met our inclusion criteria for the meta-analysis. From these articles we extracted 456 independent effect sizes, estimated from a total of 2,163,171 participants. We categorized the independent nudging interventions into the classifications of Münscher et al. (2016) and estimated the average effect size by nudging category, nudging technique and the total effect (Mertens, Herberz, Hahnel, & Brosch, forthcoming).

The results of the meta-analysis indicated that nudging interventions applying decision structure nudges were the most effective to change behaviour, with the aggregate effect size for this nudging category being significantly higher than the overall total effect (d = 0.45, 95% CI [0.39, 0.51]). However, decision information and decision assistance nudges were also successful in inducing a desired behaviour change. These results highlight the importance of nudging interventions as an alternative to traditional tools of policy makers and practitioners to induce behaviour change. Additionally, the results suggest that decision structure nudging interventions might be more successful in changing behaviour than decision information or decision assistance interventions. However, policy makers or practitioners might not always be able to implement all types of nudging interventions in a given context. For instance, a decision information nudge that increases the visibility of an important and usually covert information to the consumer (such as CO_2 emissions on energy labels), might in some cases be more publicly accepted and more easily implemented in existing procedures than changing the decision structure (e.g., implementing a default).

For the nudges tested in the present project our work could only partly benefit from the results of the meta-analysis, as it took almost the entire period of the project to conduct this intensive analysis. Indirectly, however, already early stages of the meta-analysis, such as the literature search, resulted in a comprehensive overview of existing nudging interventions in the literature and their effectiveness. These findings then fed back into the project by showing the potential transferability of the identified nudges for the adoption of fuel-efficient vehicles. If the project team had been knowledgeable of the final results of the meta-analysis at an earlier stage, the results would have guided the selection of nudges to more strongly target the decision structure. The meta-analysis found nudges targeting the decision structure to be especially effective in the environmental domain. Future research should investigate to what extent these results, based on diverse environmental contexts, apply to the domain of fuel-efficient car purchases and which structural components in the car purchase decisions would be the most promising to be targeted.

2.2. Bottom-up approach: Identification of nudging interventions in practice

The goal of the bottom-up approach was to identify the most common nudging interventions applied in Switzerland in practice to promote fuel-efficient car purchases. To this end, we implemented a mixed-method approach, combining a literature review and analysis of relevant online and social media, semi-structured interviews and ethnographic observation at related events. This resulted in an analysis of approximately 150 documents (websites of relevant stakeholders, promotional materials etc.), 30 semi-structured interviews with relevant stakeholders and visiting of 12 sector-wide events (internal and external promotional events, car salons and academic conferences).

The results firstly show that the field of fuel-efficient mobility is in Switzerland rapidly growing. A special attention has been given to electric mobility, with the majority of initiatives and car companies focusing in their strategies on battery electric vehicles (EVs) (offers, targets of the programs etc.). This is manifested for example by an increasing number of models entering the market and the rapidly expanding market share, with the sales of EVs growing in Switzerland by 143% in 2019 compared to 2018 (BFS, 2020; McKerracher et al., 2020). Alongside this trend also grow the support measures to promote sales of fuel-efficient and especially electric vehicles. They are implemented by the plurality of actors in the field. Besides the more traditional soft-policy tools such as information provision (in print and online media), test drives and gamification have gained a particular prominence (co2tieferlegen, 2018; EnergieSchweiz, 2019; Tesla, 2019).

Secondly, our analysis showed that an increasing number of actors is entering the field of fuel-efficient mobility, ranging from traditional transport sector actors (i.e. car manufacturers, car dealers, car importers etc.) to new ones, such as electric utilities, electric hardware providers etc.. The latter group is entering the market since fuel-efficient and namely electric mobility is offering them new business opportunities. For instance, electric utilities see electric mobility as a potential new customer segment; electric hardware providers are active in charging technology development and provision (Axpo, 2020; Deloitte, 2019; EM, 2019a; Smith, Sanborn, & Slaughter, 2017). Table 2 shows the multitude of actors involved in fuel-efficient mobility in Switzerland and provides examples of each identified type.

Table 2: Plurality of actors involved in fuel-efficient mobility in Switzerland; schematic outline.

Sector of activity	Type of actor	Sub-type	Example
Public governance	Public	Federal level	Swiss Federal Office of Energy (SFOE)
		Cantonal level	Canton Basel-Stadt
		Municipal level	St.Gallen, Nyon
Research	Public	Academia	UNISG, UNIGE
Transport	Private	Car manufacturers	Tesla, BMW
		Car dealers	Christian Jakob AG, City-Garage AG
		Car importers	AMAG
		Associations	E'Mobile (Electrosuisse), Autoschweiz
	Public	Associations	EnergieSchweiz (SFOE)
Energy	Private	Electric utility	Repower, Alpiq
Technical appliances	Private	Electric hardware providers	Elektro-Material AG, ABB
Finances	Private	Banking and insurance	Allianz
Property market	Private	Property owners	Allreal Holding AG, SBB, Migros

Finally, the interventions implemented to promote fuel-efficient and, mainly electric, vehicles are flourishing. They are mainly based of traditional policy measures such as regulation and financial incentives and soft-policy tools, such as information campaigns (Flammer, 2019; St.Gallen, 2017; UVEK et al., 2018). An increasing number of tools however also incorporates components of nudging interventions and aims to alter choice architecture (Keller, 2018; Khiat, 2017). Among them, the most common ones are test drives, information provision and development of public charging infrastructure. Test drives are employed by a large number of actors, ranging from car manufacturers themselves (Tesla, 2019), car dealers and car associations (Plug'nRoll, 2020g) to public sector actors (EnergieSchweiz, 2019; Vuichard, 2020). Information provision is a very well-known tool for all actors involved. However, the current interventions more actively employ insights from behavioural science and nudging techniques than pure promotional messages and advertisements in print and online media. Current communication campaigns oftentimes include gamification components (EnergieSchweiz, 2018), activities on social media (Audi, 2019) and engage consumers by a combination of a plurality of tools, such as personal feedback or reminders (co2tieferlegen, 2018; Tesla, 2019). Finally, the actors are also increasingly developing public charging network, not only to cover the real charging needs of EV drivers (Axpo, 2020; IWB, 2019; Repower, 2019). The assumed lacking coverage of public charging network remains one of the major barriers to EV purchases to date (Egbue & Long, 2012; Plananska, 2020). Hence, the development and visibility of public charging network might represent a powerful nudge to assure the public of the increasing importance and technical abilities of electric mobility, potentially and hopefully resulting in a formation of a new social norm.

2.3. Combination of the two approaches: Identification of the most promising nudges to promote fuel-efficient vehicles in Switzerland

Based on the results of the top-down and the bottom-up approach, we identified a number of promising nudges that could be tested in the context of the purchase of fuel-efficient cars (see overview of all identified promising nudges in the annual project report 2018). We evaluated this first set of nudges with respect to their general effectiveness and applicability to car purchases. The thorough study of the literature and existing best-practice examples in the field provided us with

estimates of the effectiveness of different nudging interventions. We then evaluated which of these effective nudges were applicable to any of the stages of a car purchase decision and which could be tested with our methodological means of Laboratory studies, Online studies, and one Field study. We additionally aimed to test nudges from all three nudging intervention categories (decision information, decision structure, and decision assistance, Münscher et al., 2016), which more strongly targeted either emotional or rational decision-making processes. These criteria led to the final selection of nudging interventions that are depicted in Table 3.

The status priming nudge was intended to increase preferences of more status-oriented consumers for fuel-efficient cars.; the default unit nudge was intended to increase consumer preferences for highly efficient cars through the presentation of alternative fuel consumption information as a measure of fuel-equivalence; the rank nudge was intended to increase consumer preference for electric vehicles by confronting consumers with the actual coverage of different battery ranges, based on their individual driving behavior; the bundling nudge was intended to increase consumer preference by increasing convenience through bundling the purchase of an electric car with the provision of charging services; the social norm nudge was intended to increase consumer preference for electric vehicles by presenting them with the continuing increase of electric vehicle adoption in Switzerland, leveraging consumers' desire to generally adhere to social norms; and the past framing nudge was intended to increase the support of more conservative consumers for subsidies for electric mobility by referring to successes of electric mobility in past societies.
One overarching objective of the final selection of nudges was that the results of our tests provide clear and easily implementable recommendations to Swiss policy makers and practitioners.

Table 3: Overview of the studies conducted as part of the present project. Name of the nudge, categorization within the classification of Münscher et al. (2016), targeted decision mode, and stakeholder that could most likely apply the nudge.

Study	**Nudge**	**Nudge Category**	**Nudge Technique**	**Main decision mode**	**Stakeholder**
Laboratory Study 1	Status priming effect	C. Decision assistance	C1 Provide reminders	Emotional	Industry
Laboratory Study 2	Unit effect	A. Decision information	A1 Translate information	Rational	Policy & Industry
Laboratory Study 3	Rank nudge	A. Decision information	A1 Translate information	Rational	Policy & Industry
Online Study 1	Bundling of EVs and charging services	B. Decision structure	B2 Change option-related effort	Emotional / Rational	Industry
Online Study 2	Social norms	A. Decision information	A3 Provide social reference point	Emotional	Policy & Industry
Online Study 3	Political ideology and past framing	C. Decision assistance	C1 Provide reminders	Emotional	Policy
Field Study	Bundling of EVs and charging services	B. Decision structure	B2 Change option-related effort	Emotional / Rational	Industry

3. Results and discussion

3.1. Preliminary study 1: Understanding of the vehicle purchase process and touchpoints for electric mobility

Abstract: Electric vehicles (EV) are critical to fulfilling global climate goals. Despite their environmental and societal benefits, only 2.2% of cars sold worldwide in 2018 were electric. To understand the reasons for the low level of EV purchasing and help define measures for more effectively promoting their sales, the vehicle purchase process should be understood. For this purpose, we studied consumer behavior literature and conducted an online survey of Swiss car owners (N = 553). This resulted in the generation of a novel conceptual framework of the vehicle purchase process. This consists of five stages that are underlined by differentiated decision-making strategies. Second, the results show that car dealers play a critical role at all stages of the process but remain a barrier to EV sales. Finally, the importance of a plurality of specific information sources and of the existence of charging options is significantly correlated to EV consideration. Based on these findings, touchpoints for electric mobility at relevant stages of the vehicle purchase process are identified, and policy interventions for more effectively promoting EV sales in Switzerland are suggested.

Citation: Plananska, J. (2020). Touchpoints for electric mobility: Investigating the purchase process for promoting sales of electric vehicles in Switzerland. *Energy Research & Social Science*, *69*, 101745.

3.2. Preliminary study 2: Consumer motives for green mobility

Abstract: While most consumers agree that adopting more sustainable mobility behaviors should be a priority, this attitude often fails to translate into actual behavior. We argue that this is because sustainable mobility products do not sufficiently satisfy consumer mobility motives. To investigate this issue from a multi-modal perspective, we first synthesized previous research into a general measure of superordinate consumer motives in the mobility domain. We then conducted a representative survey experiment in which potential mobility consumers (N = 504) reported their mobility motives and their purchase intentions for a diverse set of mobility products including electric vehicles, hybrid-electric vehicles, efficient fuel cars, electric bikes, annual public transport tickets and sport utility vehicles. In line with our expectations, mobility motives substantially contributed to explaining all purchase intentions on top of demographic variables and prior ownership. While environmental motives were the most important predictor, also status, financial, independence, safety and hedonic motives contributed substantially to the prediction of mobility purchase intentions. We discuss the importance of consumer motives as a basis for marketing and policy

Citation: Herberz, M., Hahnel, U.J.J., & Brosch, T. (2020). The Importance of Consumer Motives for Green Mobility: A Multi-Modal Perspective. *Transportation Research Part A: Policy and Practice, 139,* 102–18. https://doi.org/10.1016/j.tra.2020.06.021.

3.3. Laboratory study 1: Status priming effect

We conducted an experiment to investigate the relationship between status aspirations, political ideology, and environmentally relevant consumer choices of car configurations. In the literature, status aspirations have been identified to promote both, environmental (Griskevicius, Tybur, & Van den Bergh, 2010) and luxurious (Kim, Park, & Dubois, 2018) car choices. While environmental consumer choices have been successfully promoted with a general status goal activation, this study aimed to analyze whether the interaction of political ideology and the differentiation between status advancement and status maintenance goals found for luxurious choices (Kim et al., 2018) also applies in the context of environmental choices. Specifically, we recruited a sample of Swiss consumers (N = 150) and manipulated via a priming task the activation of status maintenance and status advancement goals (vs. control group). We first asked participants to rate on a scale from 1 – *not at all* to 7 – *absolutely* how environmentally friendly, luxurious, attractive, new, exciting, and expensive they considered a set of car components. The car components were tires, lights, seats, painting, GPS navigation, cladding, windows, sensors, driving mode, and type of engine. All components were separately presented in a more environmentally friendly version and a more luxurious version that both were briefly described. Subsequently, we measured how the manipulation influenced participants' choice of environmental (vs. more luxurious) versions of car components in a hypothetical car purchase scenario. Participants were presented with three different texts including either a (i) status maintenance activation, (ii) status improvement activation or (iii) control text. We adapted status activation manipulations from previous research (Kim, Park, & Dubois, 2018). For the status maintenance activation, participants were asked to think about the acknowledgement, respect and appreciation they received from others and to elaborate two to three ways they could think of to maintain their social status during the following years. For the status improvement activation, participants were asked to think about the lack of acknowledgement, respect and appreciation they encounter and to elaborate two to three ways they could think of to improve their social status during the following years. In the control condition, participants were given a task equivalent in length that asked them to elaborate about how to improve their two to three favorite dishes (see section "Material" below for original material used in the study). After being allocated to one of the three conditions participants were asked how much they felt that the texts activated their status maintenance goals, status improvement goals, general status goals, arousal, positive emotions, and negative emotions. Finally, participants had to make a choice between the environmentally friendly version and the luxurious version of three car components. These three components were individually selected based on the ratings provided by the participants at the beginning of the experiment. Each participant had to make a choice for those three car components for which the difference between the ecological rating of the ecological version and the luxurious rating of the luxurious version was smallest.

The results showed that more environmental car-configurations (e.g. LED lights) were evaluated as more environmentally friendly than luxurious car-configurations (e.g. Xenon lights). Conversely, more luxurious configurations (e.g. Xenon lights) were evaluated more luxurious than environmental configurations (e.g. LED lights). Only double-paned windows were not rated more environmentally friendly than luxurious (see Table 5 for an overview of the results). Additionally, our manipulation that was intended to activate status maintenance goals led to the hypothesized activation. That is, after the

experimental activation of status maintenance goals, participants reported to have stronger status maintenance goals as compared to the others conditions. The manipulation that was supposed to active status advancement goals, however, did not result in differential activations of status maintenance and status advancement goals. The results are depicted in Table 4. As anticipated from the ambiguous results on status activation, we did not find any difference in ecological choice of car configurations between the status goal, status maintenance, and the control condition. We attributed this lack of evidence to the relatively weak activation of status goals through the used manipulation and the non-differential activation of status enhancement goals in both status goal activation conditions (see Table 4). In the light of these null-findings, we decided that status goal activation might not be the most promising avenue to investigate the levers that could be used to convince more conservative citizens of more environmental cars. Instead of pursuing more research in relation to status goals, we turned to past-future framing (Online Study 3) to produce insights more readily applicable by practitioners and policy makers.

Table 4. Reported activations after the experimental manipulation of status maintenance and status improvement goals and control condition

Exp. condition	act_main	act_enh	act_sta	arousal	emopos	emoneg	pol.ideo
Control	1.61	1.61	1.67	1.76	3.28	1.62	5.60
Maintenance	4.49	3.78	4.49	2.46	3.98	2.36	5.64
Improvement	3.44	3.70	4.10	1.94	2.84	2.86	5.50
t-test contrast Main&Impr	< .001	.80	.13	.056	.001	.155	.70

Note. T-tests were computed with experimental condition as independent variable and the following dependent variables: act_main - status maintenance activation, act_enh – status improvement activation, act_sta – general status activation, emopos – positive emotion activation, emoneg – negative emotion activation, pol.ideo – political ideology.

Table 5. Activation ratings of all car components in both versions: ecologic and luxurious

	ecological tires	luxurious tires	ecological lights	luxurious lights	ecological seats	luxurious seats	ecological varnish	luxurious varnish	ecological GPS	luxurious GPS
Ecologic	5.53	1.91	5.69	3.41	5.33	2.28	5.53	2.61	5.09	3.47
Luxurious	3.31*	4.85*	3.98*	4.23*	4.35*	5.30*	3.81*	4.69*	3.21*	4.02*
Attractive	5.08	2.77	5.40	3.69	4.93	3.81	4.95	3.73	4.75	3.96
New	4.69	2.84	5.21	3.49	4.44	2.62	4.75	2.74	4.29	2.99
Excitement	3.55	3.11	4.19	3.45	3.91	3.31	4.00	3.49	3.75	3.39
Expensive	4.63	5.76	5.09	4.99	5.29	5.59	4.95	5.07	3.60	4.35

	ecological cladding	luxurious cladding	ecological windows	luxurious windows	ecological sensors	luxurious sensors	Eco-drive mode	Sports-drive mode	Electric engine	Sports engine
Ecologic	5.27	2.79	4.93	2.91	5.31	3.51	5.47	1.81	5.29	1.72
Luxurious	3.69*	4.99*	4.66	4.36*	3.34*	5.03*	3.56*	4.31*	3.99*	4.56*
Attractive	4.33	3.62	4.61	3.54	4.64	4.77	4.79	3.15	4.71	2.86
New	4.29	3.45	4.75	2.34	2.94	3.19	3.94	2.57	4.02	2.31
Excitement	3.55	3.46	3.74	3.13	3.29	4.08	3.86	3.27	3.92	3.17
Expensive	4.56	5.27	5.30	4.55	4.02	5.09	4.15	4.78	5.35	5.51

Note. Average ratings on a scale from 1 – “not at all” to 7 – “absolutely". Significant difference between ecologic and luxurious rating pairs are signaled with an asterisk ($p < .001$ *).

Material

Instructions for the status activation manipulation and the control text as used in the experiment:

Status maintenance activation:

"According to a recent study, maintaining a stable social status has a significant influence on individual life satisfaction. Social status here means relative social standing and the prestige, respect, or admiration accorded a person by their social environment.

Now please think for a moment about the prestige, respect, or admiration you receive in different areas of your life. Then please think of 2-3 ways to maintain your social status over the next few years and list them in the boxes below."

Status improvement activation:

"According to a recent study, increasing one's social status has a significant influence on individual life satisfaction. Social status here means one's relative social standing and the prestige, respect, or admiration accorded to a person by their social environment.

Now please think for a moment about the prestige, respect or admiration you lack in different areas of your life. Then please think of 2-3 ways to improve your social status over the next few years and list them in the boxes below."

Control text:

"According to a recent study, pasta dishes are the most eaten meal in Europe. Pasta is delicious and easy and quick to prepare. Please think of various situations in your life where you have prepared or eaten pasta.

When you have thought about it, please think of 2-3 ways you could add ingredients to these pasta dishes to make them taste (even) better. Write the ingredients in the spaces below."

3.4. Laboratory study 2: Unit effect

Abstract: The unit in which numerical information is presented can have a strong influence on how decision makers evaluate and choose between available choice options. The present work examines the influence of frequently used default units on judgments and decisions of energy efficiency. Across three experiments (N = 497), our results provide evidence that value sensitivity increases by about 25% in joint evaluation mode when a product attribute is presented in the default unit versus a non-default unit. As a result, presenting an attribute in the default unit led to more favorable evaluations of superior products and less favorable evaluations of inferior products. This result was robust to changes in the numerical magnitude of the non-default unit. Moreover, when joint evaluation was performed across different units, products described using a default unit were evaluated more favorably than products described using a non-default unit. More favorable evaluations translated into a higher willingness to pay for efficiency advantages. We discuss the theoretical and practical implications of default units to guide informed consumer judgments and effective energy efficiency labeling.

Citation: Herberz, M., Brosch, T., Hahnel, U.J.J. (2020). Kilo What? Default units increase value sensitivity in joint evaluations of energy efficiency. *Judgment and Decision Making, 15*(6), 972-988.

Open access version of the published version of the manuscript:
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3.5. Laboratory study 3: Rank nudge

The environmental impact of consumer products gains more and more importance, both as a sales argument on the seller's side and as a buying argument on the consumer's side. However, environmental impact tends to be communicated in ways that are not easily understood by the consumer, such as the CO_2 emissions emitted by a product presented in grams or kilograms. Based on research on rank-based decision making, we hypothesized that consumer are more sensitive to environmental impact information when the unit used to describe the impact facilitates mental ranking. In the present study we investigated this hypothesis in the context of consumers' (N = 271) sensitivity to environmental impact information presented on common car energy labels. The experimental set-up of this study was identical to the one used in Laboratory Study 2. However, instead of manipulating different ways of presenting fuel or energy consumption, we presented different group of participants with translations of fuel consumption in liters per 100 km into either (i) grams CO_2 emissions per km, (ii) total cost of ownership per year and (iii) fuel consumption rank within the entire population of cars on the European car market. Additionally, each participant not only rated the environmental image but also the financial image (1 = expensive to 7 = inexpensive) and the fuel efficiency (1 = inefficient to 7 = efficient) of the cars. We hypothesized that consumer ratings would be more sensitive when attributes were easier to evaluate (e.g., rank nudge > fuel consumption > CO_2 emissions) and when the attribute semantically fits the evaluated outcome (e.g., total cost of ownership for financial image).

In line with our expectations, our results show that consumers' environmental and efficiency ratings of cars are most sensitive when provided with information on how the fuel consumption of a given car ranks among all currently available cars on the market. In comparison, consumers' evaluations are somewhat less sensitive to consumption information presented in liters per 100 km, and even less sensitive to CO_2 emission information presented in grams per kilometer (see Panel A and B of Figure 1). For the financial ratings of the cars, information on the total cost of ownership produced a comparable value sensitivity as the fuel consumption rank (see Panel C of Figure 1). In summary, while more abstract rank information, and partly also liters fuel consumption, result in high value sensitivity across environmental, financial, and efficiency ratings, more domain specific units such as total cost of ownership and CO_2 emissions only resulted in high value sensitivity for outcomes that are closely related to the unit (i.e., total cost of ownership lead to accurate financial ratings and CO_2 emission information lead to accurate environmental ratings). These results indicate that more abstract attribute units used on the energy label of cars, such as a fuel consumption rank nudge and fuel consumption in liters per 100 km, might allow consumers with different goals (e.g., cost minimization vs. environmental) to be equally guided towards more efficient car purchases. These units should be presented more prominently than more specific units, in order to inform consumers and avoid back-fire effects of information that is not in line with consumers' goals (e.g., environmental information for consumers with a negative attitude towards the environment) or null-effects of information that is difficult to evaluate such as CO_2 emissions expressed in grams per km. At the current state of research, our results are somewhat premature to fully recommend the use of the consumption rank nudge in practice. Future research that extends the findings from this first empirical study whose results might be limited to the investigated sample of German car drivers and to consumer judgments and not actual preferences (e.g., choices or willingness to pay) should further validate the value of the rank nudge. Given this need for further research, a fuel consumption in liters per 100 km seems to strike an optimal balance between a high consumer value sensitivity to car efficiency, costs, and environmental image and its familiarity, as identified in Laboratory Study 2 of this report.

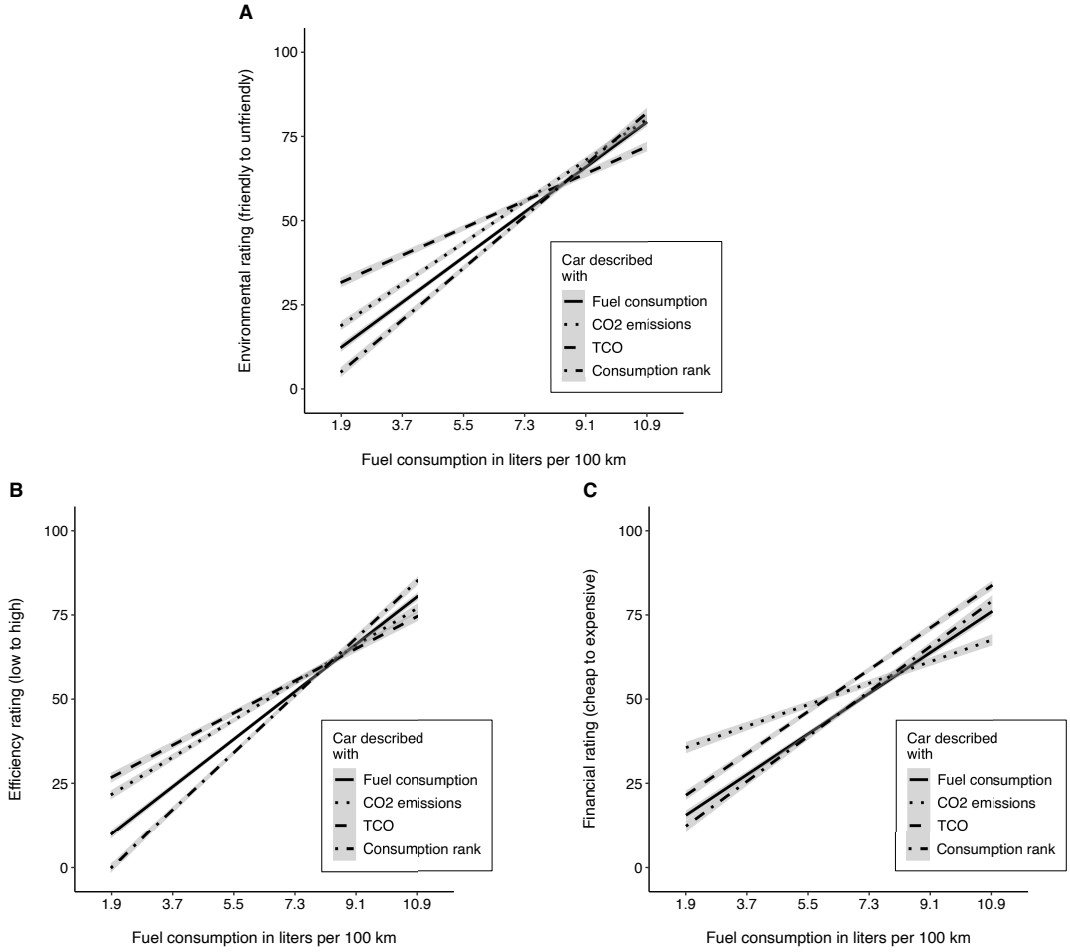

Figure 1. Environmental, fuel efficiency, and financial ratings for cars with different levels of fuel consumption and depending on the unit presented to consumers. Overall, consumers' ratings were most sensitive when provided with the rank nudge, then fuel consumption, then CO2 emissions, and lastly total cost of ownership. Grey areas indicated 95% confidence intervals of the estimated regression line.

3.6. Online study 1: Bundling of EVs and charging services

The adoption of electric vehicles (EVs) is increasing (EAFO, 2021). While it is widely known what factors determine EV purchases among the first innovative adopters (Chen et al., 2020; Hardman et al., 2016), the studies of consumer preferences among wider adopter groups that are currently entering the market are only slowly emerging (de Rubens, 2019). We thus need to better understand the latter and what strategies to implement to most effectively foster EV purchases among prospective EV adopters.

One possible strategy to promote EV adoption among wider adopters is product bundling. Product bundling has been effectively implemented in other areas of pro-environmental behavior to promote purchases among wider adopter segments (Candel, 2001; Wüstenhagen et al., 2003). Bundles of EVs and additional, mainly charging services, have thus been offered in practice (BMW, 2020; Plug'n Roll, 2020). First studies have investigated and found a positive effect of this marketing strategy on EV customer acceptance. However, they either do not empirically test the identified bundles (Cherubini, 2015) or test bundles not yet implemented in practice, such as EV, PV and battery storage (Priessner & Hampl, 2020) or EV and community solar offerings (Stauch, 2021). No investigation to date has empirically investigated the effect of one of the most relevant and commonly applied bundles to date, that of EVs and charging services. We have decided to address this literature gap by conducting two studies, first one analysing the effect of this essential bundle type on EV purchase willingness of Swiss consumers in an online experiment. Second study investigates its preferred set-up among individual customer segments through a choice experiment.

Between-subject design experiment

First, we conducted a between-subject design experiment. It controlled for the effect of two experimental conditions – bundle and individual components – on EV purchase willingness of prospective Swiss EV adopters. The sample for the analysis consisted of 186 respondents from Switzerland. We filtered out owners of EVs or hybrid cars (N = 20) and respondents who stated that they do not intend to buy a car ever again (N = 9). We can assume that both groups would not react to the experimental stimuli. Second, we compared the two experimental conditions only (excluding the control group, N = 284) to better correspond to a real-life situation. When considering an EV purchase, customers are sooner or later confronted with the complexity of operating an EV.

The effect of providing a bundle and knowledge about the components necessary for operating an EV explained a significant share of the variance in willingness to purchase an EV (R^2 = .134, $F_{(3,182)}$ = 9.407, p < .001). We observe that knowledge about the components necessary for operating an EV is a critical success factor that fosters willingness to buy this engine technology (B = .549, SE = .115, t = 4.767, p < .001). The results also demonstrate that providing a bundle to the customer as a means of decreasing the complexity encountered when purchasing an EV marginally increases willingness to purchase this engine technology (B = .352, SE = .206, t = 1.710, p < .1). However, this effect is moderated by customers' level of knowledge about the components necessary for operating an EV (B = -.339, SE = .152, t = -2.226, p < .05). In particular, it is indicated that bundling is an effective strategy for customers with low levels of knowledge (B = .810, SE = .296, t = 2.734, p < .01). The benefit of providing a bundle is not sustained with increasing levels of knowledge (middle level: B = .352, SE = .206, t = 1.710, p < .1; high level: p > .1) As depicted in Figure 2, the effect of bundle is actually lower than that of individual components for consumers with high levels of knowledge of components

necessary for EV operation. We can assume that such consumers are already well aware of the complexity of using an EV and thus providing a bundle is not of added value to them.

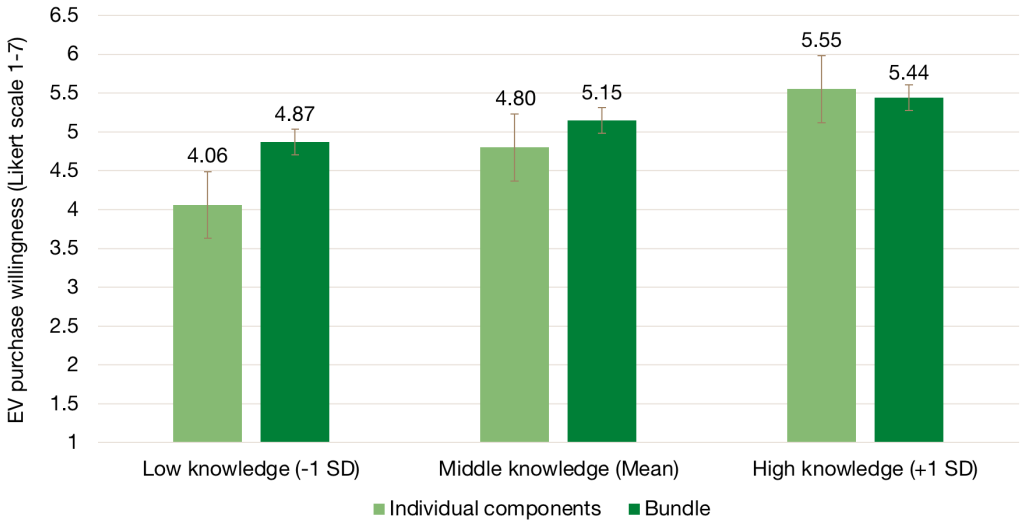

Figure 2. EV purchase willingness, the effect of experimental conditions and the level of knowledge about components necessary for operating an EV.

Choice experiment

Second, we conducted a choice experiment and applied latent class analysis to identify the preferred set-up of a bundle of EV and additional services for individual segments of prospective Swiss EV adopters. The sample was based on 304 participants from Switzerland. From the total number of respondents (N = 313), we filtered out those who stated that they did not intend to buy a car in the future (N = 9), since the choice task would have been irrelevant to them. In contrast to the filter applied in the analysis of the between-subject design experiment, we included the owners of EVs and hybrid cars (N = 20). Since these respondents already have experience with operating an EV or a hybrid car, their choices can result from their experience and thus be even more relevant for the data analysis.

The latent class analysis, allowing to cluster segments of respondents based on their decisions in the choice task, showed that an ideal number of segments is 3 (by extrapolating percent certainty, CAIC and chi-square scores). Based on the identified preferences, we call the latter *Tech-oriented adopters* (n = 67), *Convenience-oriented adopters* (n = 170), and *Likely non-adopters* (n = 67). We believe that members of the latter segment are likely non-adopters of the bundle first due to the high value they attach to the none option (398.04). Second, this segment attaches the lowest importance scores to the attributes green electricity certificate and the installation of the private charging station, which these respondents would actually prefer not to have included in the bundle at all. Since the installation of the private charging station is a fundamental component of the bundle offer, this segment is seen as not likely to pursue a bundle solution.

The former two segments, in contrast, are seen as likely adopters of two distinct types of bundle offers. *Tech-oriented adopters* attach substantially greater importance to the four key technological

components of the bundle of EV and charging services – installation of the private charging station (26.98%), price (19.21%), an app to operate the private charging station (15.39%), and access to the public charging network (12.99%). While insurance is not desired by this segment, battery assistance and a green electricity certificate are only marginally influential in terms of the choice of bundle, with respective importance scores of 8.77% and 7.66%. The part-worth utilities, reflecting the weight of the attribute levels in the decision process, show us that the segment would prefer a pre-paid credit card for the public charging network of the lowest value offered: 30 CHF (49.13). This may however not be due to the price sensitivity of the segment. While preferring the bundle price of 3,500 CHF (61.48), this segment is the only one that attaches positive utility to the middle-priced option of 4,000 CHF (11.50). Although the part-worth utility of the none option is positive for this segment (233.80), it is much less than the value for the sum of the individual attribute levels. Therefore, the bundle is of positive value to *Tech-oriented adopters*. They prefer a narrower set-up focusing on essential components for charging.

Convenience-oriented adopters are by far the largest segment, representing 55.9% of the sample. They are most likely to opt for the bundle, as attested to by the negative part-worth utility of the none option (-851.91). The segment prefers the most complete bundle. This is proven by the balanced importance scores the segment attaches to the individual attributes, ranging from 28.01% for installation of the private charging station to 10.60% for insurance. The part-worth utilities show that this segment (i.e., convenience-oriented adopters) would prefer the attributes of battery assistance for both Switzerland and Europe (44.36), access to the public charging network with the pre-paid credit card worth 150 CHF (40.01), a green electricity certificate for the distance of 10,000 km (39.99), and insurance of the vehicle only (31.17). The segment would prefer to have a private charging station operated by an app (38.93) and attaches the largest positive value to the lowest price of 3,500 CHF (44.36). Its strong preference for the bundle is demonstrated by the fact that it is the only segment that attaches negative part-worth utilities if either of the components is not included.

Discussion

Our study has implications for both academia and practice. As the first study in the field, we show that bundles of EVs and charging services can be an effective strategy to foster EV purchase willingness among future adopter groups. However, we find that knowledge is a statistically significant predictor of that effect. Namely, bundling increases EV purchase willingness only of those consumers with low pre-existing knowledge of components necessary to operate an EV. We thus not only answer the call of Priessner & Hampl (2020), Cherubini et al. (2015) to identify the mechanisms on which bundles operate. We also show that this strategy can be effective to overcome one of the biggest barriers to EV purchases to date, that of limited EV-related knowledge (Kester et al., 2018; Plananska, 2020). With the increasing convenience orientation and lower willingness to increase EV-related knowledge among wider adopter groups (Rogers, 2003), the relevance of this strategy will only further increase in the future.

We recommend policy makers to promote EV-charging bundles both financially and administratively. Since investments in charging infrastructure are oftentimes more effective and cheaper than financial incentives upon EV purchase price only (Sierzchula et al., 2014; Ye et al., 2021), we recommend financially subsidizing bundles of EVs and charging services instead. Second, policy makers should implement building codes that would make obligatory for any new housing developments to include charging infrastructure or, at minimum, include infrastructure conducive to their future development.

For practice, we recommend pursuing differentiated bundling strategies. First, our results encourage further offering of narrow bundles of EV-charging services only. Secondly and maybe even more importantly, we see that a substantial proportion of prospective EV adopters would prefer a large, convenient bundle, including besides charging also additional services such as insurance, battery assistance and green electricity certificate. We recommend car manufacturers, car dealers and charging service providers to develop this broader bundle type. With the growing convenience orientation of later adopter groups (Rogers, 2003), we expect its relevance to further grow in the future.

3.7. Online study 2: Social norms

Social influence has been confirmed to play a role in EV adoption decisions (Nordlund et al., 2016; Rezvani et al., 2015). However, social norm interventions have not been indefinitely proven to motivate EV preferences. While certain studies conclude on their major role (Barth et al., 2016; Jansson, 2017), DellaValle and Zubaryeva (2019) did not find an effect of social norm intervention on EV purchase willingness of Italian consumers. The goal of this research is to contribute to this literature, in particular to analyse if social norm salience can increase EV purchase willingness of Swiss customers.

To achieve our objectives, we conducted an online, single factor between-subject design experiment. It included four experimental and one control condition. We selected a sample of 368 Swiss respondents who had indicated an interest to purchase a car in the next 2-5 years. This condition was implemented to make the hypothetical scenario more realistic for participants. The survey was distributed by a Swiss market research agency that recruited and compensated the respondents upon participation.

The experimental conditions tested individual types of social normative interventions, namely descriptive dynamic social norms (condition 1 and 2), injunctive social norms (condition 3), and their combination (condition 4). The framing focused on the recent growth of EV sales (condition 1), recent decline of sales of ICEs (conditions 2 and 4) and the increasing use of #SUVShame on social media (condition 3 and 4). The exact framing of individual experimental conditions was as follows:

1. *An increasing number of people in Switzerland is currently buying EVs. The sales data confirm this trend. Compared to 2018, the sales of EVs have increased by 157.7% in 2019.*
2. *A decreasing number of people in Switzerland is currently buying combustion engine vehicles (ICEs). The sales data confirm this trend. Compared to 2018, the sales of cars running on diesel have decreased by 11.9% in 2019.*
3. *SUVs (off-road vehicles) have been increasingly criticised, mainly due to the recent wave of Climate change protests (Fridays for Future). This trend materialises on social media (Twitter, Instagram) via the use of hashtags such as #SUVShame.*
4. *A decreasing number of people in Switzerland is currently buying combustion engine vehicles. Compared to 2018, the sales of cars running on diesel have decreased by 12% in 2019. Moreover, SUVs (off-road vehicles) have been increasingly criticised, mainly due to the recent wave of Climate change protests (Fridays for Future). This trend materialises on social media (Twitter, Instagram) via the use of hashtags such as #SUVShame.*

After the exposure to individual experimental conditions (or a control group), respondents were asked to indicate their EV purchase willingness, measured on a five-point Likert scale from very unlikely (1) to very likely (5). Additionally, while conditions 1 and 2 were followed with a five-point Likert scale question asking respondents if they find the communicated message credible (not at all credible (1) to very credible (5)), conditions 3 and 4 were followed by a question if the respondents would dislike (1) or like (5) the #SUVShame if they saw the hashtag on social media.

First, we see that social normative interventions have to date only a limited effect on EV purchase willingness of Swiss respondents. The highest EV purchase willingness is expressed by the respondents exposed to the experimental condition 3 (M = 3.49, SE = 0.17, N = 72). However, the differences between individual experimental groups and the control group are not statistically significant, as can be seen in Figure 3. The figure also shows that there are no statistically significant differences between the individual types of normative interventions employed.

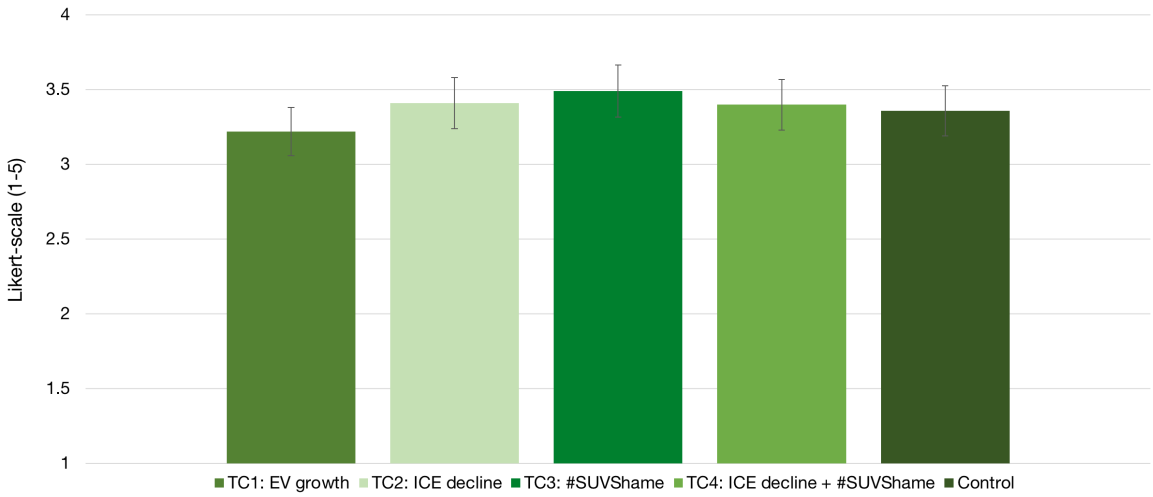

Figure 3. EV purchase willingness, individual experimental conditions and the control group.

Significant effects, however, emerge when controlling for credibility and familiarity of social normative interventions. First, credibility is a statistically significant predictor of EV purchase willingness (b = 0.410, SE = 0.111, p < .001). As can be seen in Figure 4, respondents who find the communicated message on the recent growth of EV sales credible (experimental condition 1) express statistically significantly higher EV purchase willingness than the control group (ANOVA, F(1,103) = 2.992, p = 0.087) and than the respondents who do not believe the communicated message (ANOVA, F(1,50) = 14.411, p < .001). The latter respondent group, i.e., respondents who do not believe the communicated message, however, expresses significantly lower EV purchase willingness than the control group (ANOVA, F(1,93) = 8.269, p = 0.005). This can indicate the so-called boomerang effect and has important implications for policy interventions, as more in detail explained in the section 4.2 of this report. Finally, experimental condition 2 featuring the recent decline of ICE sales did not show any statistically significant differences, neither between the respondents who believed and did not believe the communicated message, nor with the control group.

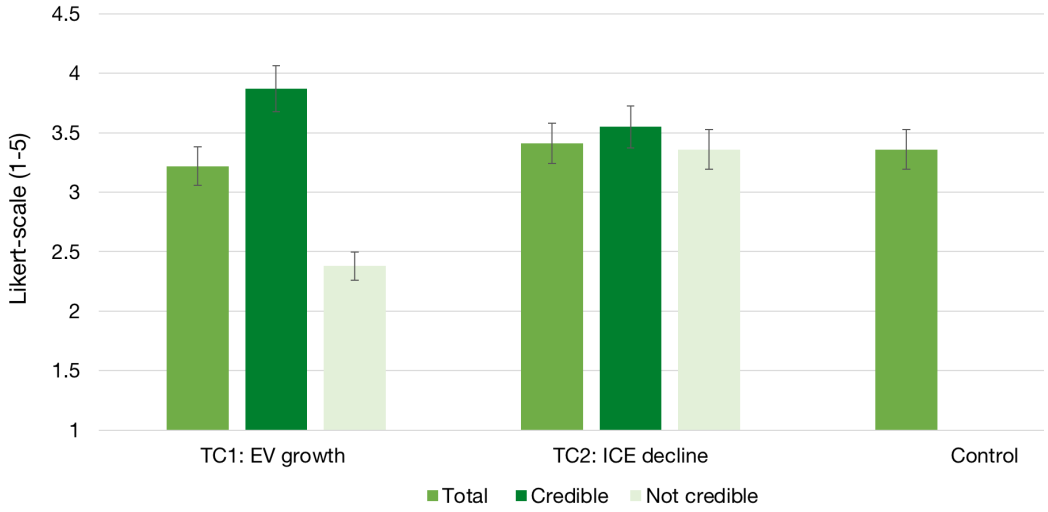

Figure 4. EV purchase willingness, experimental conditions 1 and 2 and the control group, controlling for the credibility of social normative interventions.
Note: Credible – 1 and 2 on the Likert-scale; Not credible – 4 and 5 on the Likert-scale.

We then controlled for whether respondents would express like or dislike on social media if they saw the hashtag *#SUVShame* (i.e., familiarity). First, result show that familiarity is a statistically significant predictor of EV purchase willingness in interaction with the experimental condition (#SUVshame in Condition 3) (b = 0.120, SE = 0.059, p = 0.042). Expressing like on social media to both conditions (Conditions 3 and 4) correlates with significantly higher EV purchase willingness, both if measured in contrast to the control group as well as to the respondents who would dislike the respective information (see Figure 5). These differences are slightly stronger within the experimental condition 3 (ANOVA, F(1,49) = 12.686, p = .001 between like and dislike, ANOVA, F(1,91) = 8.793, p = .004 between like and the control group) than within the experimental condition 4 (ANOVA, F(1,42) = 6.021, p = .018 between like and dislike, ANOVA, F(1,91) = 4.015, p = .048 between like and the control group). In contrast to the experimental conditions 1 and 2, there are no statistically significant differences between the control group and the respondents who disliked either of the experimental conditions. Taken together, the findings indicate that the influence of social norm information on EV purchase willingness depends on whether drivers are already familiar with such information and on the extent to which they support it. Independent of social norm information provision, this group has overall a high willingness to purchase an EV.

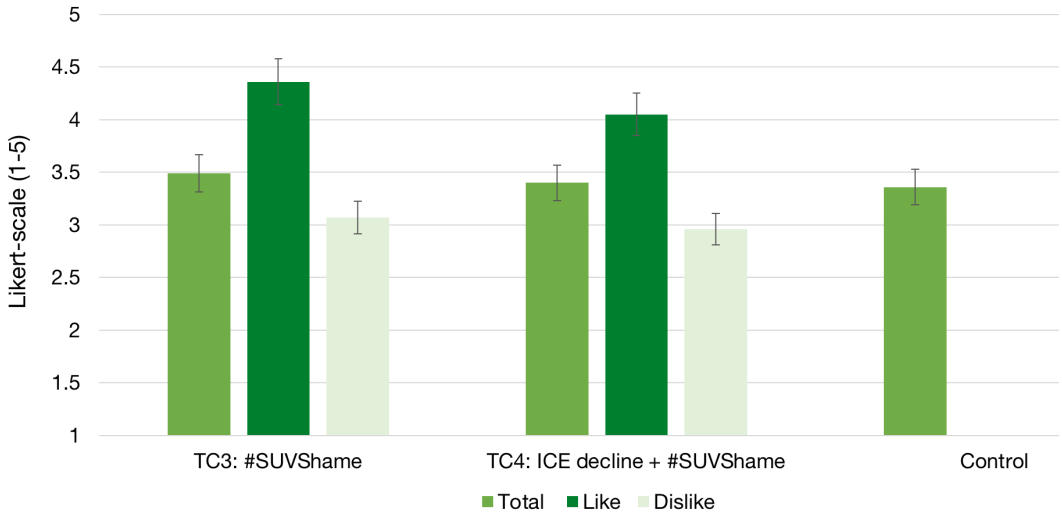

Figure 5. EV purchase willingness, experimental conditions 3 and 4 and the control group, controlling for the familiarity with the social normative interventions.
Note: Like – 1 and 2 on the Likert-scale; Dislike – 4 and 5 on the Likert-scale.

Discussion

Our results bring important contributions to both academia and practice. First, we expand the growing literature in the field (Barth et al., 206; Jansson et al., 2017 DellaValle & Zubaryeva, 2019) by an empirical investigation of social normative intervention of Swiss consumers. We also answer the calls of Campo & Cameron (2006) by testing multiple types of social norms interventions in one study, especially comparing the effect of injunctive and descriptive social norms.

We see that, currently, social norms do not have a significant effect on EV purchase willingness. Similarly, individual types of social norms do not significantly vary in their role. However, important effects emerge when looking deeper at the operating factors of social normative interventions. Finding credibility and familiarity as significant predictors of EV purchase willingness, we confirm findings of other literature concluding on the important effect of these two moderating factors of social norm interventions (Campo & Cameron, 2006; Park et al., 2011). We highlight the role of credibility by finding the so-called “boomerang effect” (Sherif & Hovland, 1961), i.e., the lowered EV purchase willingness if the communicated message is not credible to the audience.

These findings lead to important recommendations to policy and practice. We first recommend regularly communicating on the recent growth of EV sales and benefits of EVs, ideally on social media and using established hashtags that consumers are familiar with. Such a frequency and consistency might increase the familiarity of consumers with the topic and thus help generate new social norms around EV adoption and use. The messages should be accompanied by relevant data in order to increase their credibility. Second, we suggest targeting the messages to individual consumer segments based on their existing preferences. Social media and the progress of data science can help with such targeting approaches to gear the messages to the respective audience.

3.8. Online study 3: Political ideology and past framing

Much of the language used to promote environmental policy making is future oriented, and thereby speaks to citizens with liberal and progressive political beliefs. Politically conservatives, however, tend to generally oppose progressive changes in society. We suggest that this misalignment of future oriented language and conservative political beliefs is partly responsible for the political divide in support for environmental policies. To test this assumption, we conducted three online experiments in Switzerland (N_{total} = 2012) in which participants read a future (vs. past) framed newspaper article that promoted a state subsidy for electric mobility. In addition, Study 2 and 3 varied if the author of the article affiliated to a more liberal or more conservative party.

Participants reported their political ideology (from 1 = extreme left to 10 = extreme right) and their hypothetical support for additional subsidies for electric vehicles in a Swiss referendum after having read a fictitious newspaper article promoting these subsidies. In Study 1, participants either read the article presenting electric mobility as a technology whose origins lie in the beginning of the 20th century (i.e., past framing) or as a technology that will guide present society into a new era of mobility (i.e., future framing). We expected that in general, more conservative citizens are less supportive of a subsidy of electric vehicles than more liberal citizens. Additionally and in line with previous research, we expected that a past framing increases the support of more conservative citizens for additional state subsidies to promote electric vehicles (Baldwin & Lammers, 2016). Contrarily to this hypothesis we did not find the expected interaction between the past-future framing of the newspaper article and participants' political ideology (see Panel A of *Figure 6)*. However, we found a significant interaction of participants' own political ideology and the perceived political ideology of the author of the newspaper article on subsidy support. This effect has been previously documented in the literature as the partisan effect, where citizens tend to support political policies when they are promoted by a representative of one's own political ideology (Cohen, 2003). To follow up on this finding, we decided to directly experimentally manipulate the party affiliation of the author in Study 2. In Study 2, all participants read the future-oriented article from Study 1, but the author of the newspaper article was either communicated as being member of a more right-winged Swiss political party (i.e., Schweizer Volkspartei) or of a more left-winged Swiss political party (i.e., Sozialdemokratische Partei der Schweiz). In line with our expectations, the manipulated party affiliation significantly interacted with participants' own political ideology to influence support for additional state subsidies for electric vehicles (see Panel B of *Figure 6*).

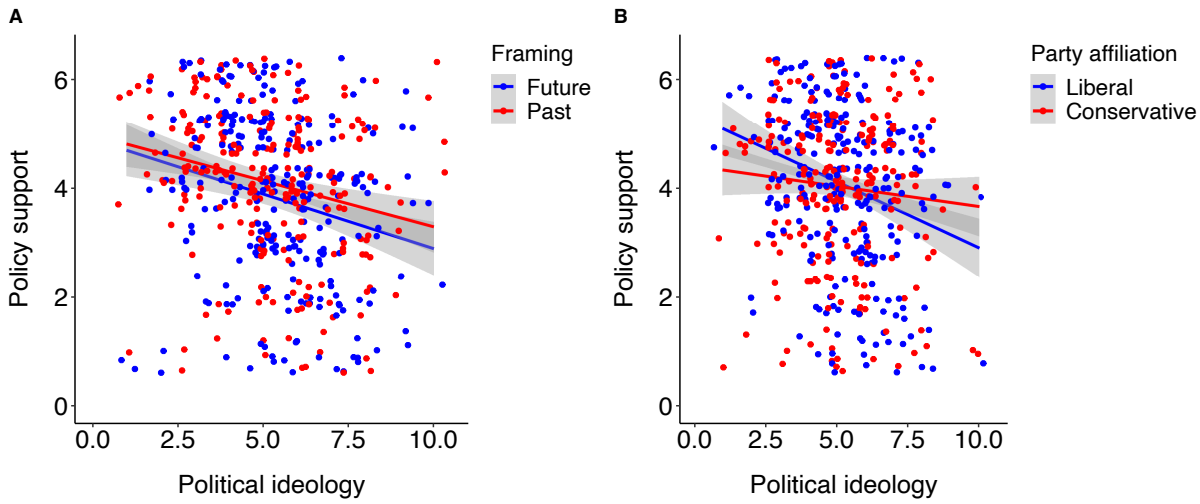

Figure 6. Panel A shows the results of Study 1: There was no interaction of the past-future framing and participants' own political ideology on the support of additional subsidies for electric vehicles. Panel B shows that manipulating the party affiliation of the author of the newspaper article significantly interacted with participants' own political ideology to influence policy support. When the author was communicated as being a member of the more conservative party, more liberal participants were less supportive of the policy while more conservative participants were more supportive of the policy. Policy support was measured on a scale from 1 = absolutely against to 6 = absolutely in favor and political ideology was measured on a scale from 1 = extreme left to 10 = extreme right. Grey areas indicate 95% confidence intervals of the estimated regression lines.

In Study 3, we combined the framing manipulation of Study 1 and the party affiliation manipulation from Study 2 to learn more about the interaction of the two effects and their result on environmental policy support. Participants were assigned to 4 conditions: They either read the future-oriented version of the newspaper article being authored by either a politically left or right party member, or the past-oriented version being authored by either a politically left or right party member. Participants then reported how they perceived the political ideology of the author of the newspaper article from a scale from 1 = extreme left to 10 = extreme right and indicated to what extent they would support the promoted policy in a Swiss referendum. The results revealed that both, party past-future framing as well as party affiliation seem to influence participants' perception of the political ideology of the author of the newspaper article (see Panel A of *Figure 7*). Interestingly, only the combination of past-framing and conservative party affiliation differed from all other conditions in predicting support for additional subsidies of electric vehicles (see Panel B of *Figure 7*). On the basis of our results, we conclude that a simple past-framing of environmental policies might not be sufficient to elicited the support of more conservative citizens, as previously suggested (Baldwin & Lammers, 2016). It seems that a past-framing only increases policy support when the message is conveyed by someone already affiliated to a more conservative political party. On a cautionary note, however, policy makers should be aware that past-framed communication by conservative politicians might not only increase the support of more conservative citizens but also reduce the support of more liberal citizens, as suggested by our data.

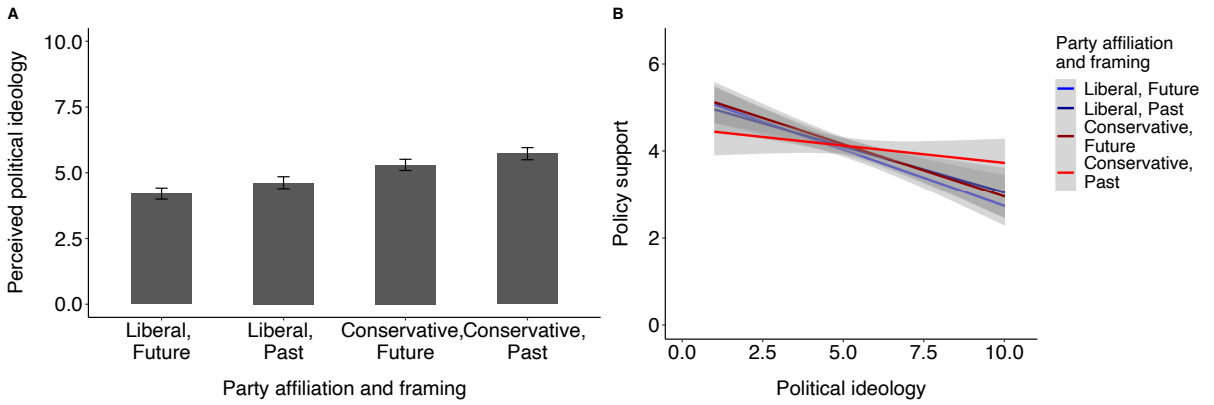

Figure 7. Panel A shows the perceived political ideology of the author of the newspaper article by experimental condition in Study 3. While a future-framing of the article and the affiliation of the author to the liberal party led to a more liberal perception of the author's ideology, a past-framing and the affiliation to a conservative aprty led to a more conservative perception of the author's ideology. Panel B shows the support of additional state subsidies by experimental condition in Study 3. Merely the combination of a past-framing and the affiliation to a more conservative party led to an increase in the support of additional subsidies of electric vehicles by more conservative participants. Error bars and grey areas indicate 95% confidence intervals of the mean and the estimated regression lines.

3.9. Field study: Bundling of EVs and charging services

Abstract: The goal of science is to generate in practice applicable findings, enhancing human welfare in reality as much as within the controlled environment of online and laboratory studies. We thus aimed in our project to also test one of the identified and empirically studied nudges in practice. With our project partner Plug'n Roll by Repower, a Swiss electric utility, we tested the convenience nudge of bundle of EVs and charging services analysed in Online study 1. The sample for Online study 1 was 313 Swiss respondents interested or having neutral views towards EVs. Aiming to collaborate with selected car dealers, we wanted to see if the bundle, if provided together with the electric vehicle (EV) at the point of sale at car dealer salons, increases EV interest and EV purchase willingness of Swiss customers. Launched in December 2019 and planned to run over the course of 2020, the progress of the field test was severely impacted by the outbreak of COVID-19 pandemic. With the spring car fairs where the product was planned to be introduced cancelled and the overall economic activity halted, the original planning of the field test during the whole year 2020 was importantly disrupted and limited. Despite these difficulties, a collaboration with one car dealer was launched. Data could have been gathered by the means of interviews with the project partner, the car dealer and a customer online survey (responded by three Swiss consumers). Firstly, observations from both interviews and the online survey show that the bundle can be effective to increase attention of consumers to electric vehicles. However, this effect does not yet translate into direct EV purchases. Secondly, both the electric utility and the car dealer agreed that the bundle is a good product to have in its portfolio. It increases attention to electric mobility by potential customers and helps overcome the complexity raised by electric car purchase, namely the need to organise all charging components. The bundle has an added value to car dealers themselves, providing them with necessary knowledge of charging services and thus potentially boosting their confidence to discuss and offer electric cars. The interviews moreover revealed that the bundle can have positive unintended consequences, such as launching new partnerships and new business opportunities that might translate into sales of different products. Finally, the interview with the project partner showed the need to enlarge the portfolio of offered bundle products, focusing especially on community garages and the possibility to rent the charging station for a monthly fee rather than its direct purchase.

3.9.1. Rationale of the field study

The goal of the field test was to study in practice the decision structure nudge that was empirically tested in Online study 1. Online study 1, among others, aimed to identify if a bundle of EV and charging services (private charging station and its installation, access to the public charging network and green electricity certificate) can increase EV purchase willingness of Swiss consumers. To do so, an online survey was conducted that included a between-subject design experiment. The sample of the study was 313 Swiss consumers interested or having neutral views towards EVs. The results showed that a bundle of EV and charging services increases EV purchase willingness of Swiss consumers who have low pre-existing knowledge of the components necessary to operate an EV. We wanted to see if this effect persists in practice and thus decided to conduct a field test. For that, we partnered with a Swiss electric utility Repower, namely its part focusing on electric mobility, Plug'n Roll by Repower (Plug'nRoll, 2020f). With the increasing role of electric mobility, electric utilities are entering the market to reap the benefits this new market segment brings. They thus add new business models to their core competencies, namely the development and management of charging services (private and public charging networks) (Deloitte, 2019; Smith et al., 2017). Repower AG is one such utility, dedicating part of its company solely to electric mobility. Plug'n Roll by Repower is focusing on charging station deployment, operating a network of public charging stations itself and partnering with other providers in Switzerland and abroad (Plug'nRoll, 2020e). They moreover provide charging solutions to individual consumers and companies, offering options for charging in a private garage, community garages of apartment buildings and businesses (Plug'nRoll, 2020d).

Searching for innovative products to enrich its portfolio and thus to better position themselves in the expanding electric mobility market in Switzerland, Plug'n Roll by Repower was open to collaborate with us on the field test, developing and testing the bundle identified in the Online study 1 in practice. The collaboration was agreed upon by the letter of intent from March 2017. The project partners then kept on communicating and narrowing down the potential content and progress of the field test, mainly since March 2018 when the EWG project was kicked-off internally by UNISG and UNIGE.

3.9.2. Start of the field study and impact of COVID-19 on its progress

The field study was kicked-off by a joint meeting between UNISG team and the team of Plug'n Roll by Repower in December 2019. At this meeting, we agreed on the planning and individual components of the field test, namely the activities planned (launch of the product online on the Plug'n Roll by Repower website in January 2020, contacting individual car dealers in January and February 2020, launch of the product with the identified car dealers at the spring car fairs 2020 etc.). Secondly, we also agreed on the final set-up of the bundle to be launched and tested (in detail discussed in the next section). Finally, we reviewed the template of the website on which the bundle was offered and suggested some modifications. The marketing team of the company then reviewed and implemented them for the final website launch in January 2020 (Plug'nRoll, 2020a).

The data collection phase was planned for the first half of 2020, mainly for March - June 2020. Plug'n Roll by Repower wanted to launch the collaboration with approximately 10 car dealers. We were then aiming to present the product together with the car dealers and the Plug'n Roll by Repower team at the spring car fairs, at which we would raise the awareness among potential customers of the project. Consequently, the product was planned to be offered at the salons of car dealers. Interested customers would be informed about the research project and invited to participate in an online survey (incentivized by a gamification aspect to increase the number of respondents) and a follow-up interview. After the initial spring phase, we wanted to conduct interviews with all participating car

dealers on their experience with the product and the field test. We would then analyze the gathered data throughout the summer 2020 and see how to proceed further in fall 2020 to successfully conclude the field study by the end of the year 2020.

The Plug'n Roll by Repower team started contacting the car dealers in January 2020. The company managed to contact 10 car dealers and launched a collaboration with one of them. We launched the online survey and prepared all necessary documents for the product promotion at car dealer salons and spring car fairs (information postcards for customers inviting them to participate in the online survey and the interview, more detailed information for car dealers about the project and possibility to conduct an interview etc.). The promising start of the project was however significantly hindered by the increasing threat of COVID-19 pandemic, fully outbreaking in Switzerland at the beginning of March 2020. The proclamation of the State of Emergency (Ausserordentliche Lage) in Switzerland on March 16, 2020 precluded any further steps planned by the team to be undertaken. Namely, all spring car fairs at which we planned to present the product were cancelled. Secondly, the limited business activity also made impossible for Plug'n Roll to proceed with the discussion with selected car dealers, thus capping the number of partnerships to one. All the activities related to the field study were more or less halted until summer 2020.

Although the state of emergency was effectively ended on June 19, 2020, the business was only slowly recovering and was not fully back to the pre-pandemic levels throughout the whole summer 2020. Moreover, the pandemic further intensified in October 2020, leading up to the second wave and strengthening of the measures to stop the spread of the virus in November 2020. Business activities were thus again severely hindered, which further precluded the progress of the field test. Additional repercussions of the pandemic are influencing the sector, such as delays in deliveries of number of EV models that could not have been finalized on time due to production closures. These limitations have been experienced by the team. Firstly, while Plug'n Roll by Repower contacted additional 5 car dealers in summer 2020, the discussions again halted in fall, thus not materializing into any new collaborations. UNISG team also participated at the Tag der Elektromobilität 2020, a Swiss-wide event organized by Elektromobilclub Schweiz (ECS Schweiz) to promote electric mobility (ECS, 2020). Plug'n Roll by Repower organized a related event in Landquart on August 22, 2020, inviting other actors from the electric mobility sector to promote their products (Plug'nRoll, 2020g). We also came to promote the bundle and gather impressions from potential customers, inviting them to participate in the online survey. The event was however only sparsely visited. We have gathered impressions from approximately 20 people and 2 more responses to the online survey.

3.9.3. Set-up of the tested bundle of EVs and charging services

The bundle tested as part of the field study and offered on the website of Plug'n Roll by Repower since January 2020 (Plug'nRoll, 2020a) consists of a (1) private charger and its installation, (2) access to the public charging network, and (3) a green electricity certificate. See Figure 8 for the graphical illustration of the offer as portrayed on the website of Plug'n Roll by Repower (Plug'nRoll, 2020a).

Figure 8. Bundle of charging services tested by the field study (Plug'nRoll, 2020a).

Firstly, the bundle includes a private charging station Pulsar plus (Plug'nRoll, 2020c) together with its installation. Upon purchase, consumers thus get not only the charging station; a skilled technical personal comes to their home to install the charging station. Secondly, the customer is given the access (via an app and an e-driver card) to the network of public charging stations developed by Repower or that Repower cooperates with, covering approximately 5'500 charging points in Switzerland and 40'000 across Europe (Plug'nRoll, 2020e). The customer also receives an access card pre-paid with a credit of 30 CHF that can be used for charging at any public station belonging to the network. Thirdly, the bundle includes a green electricity certificate (Ökostrom-Vignette). The certificate assures investment in electricity generation from renewable sources of energy. The certificate included in the bundle covers the generation of green electricity sufficient for driving an EV for approximately 10'000 km.

The one-off purchase price of this bundle is 3'333 CHF; provided that no additional costs result from private charging station installation. In case that the installation of the private charger is exceptionally complex (i.e., harder to reach garage etc.), the price can potentially grow. To identify these higher costs, Plug'n Roll offers customers a feasibility check ("Eignungscheck") for free before a potential product order. This feasibility check assesses the technical possibilities of the installation of the charging station in customer's garage, as a result of which the final price of the bundle is adjusted (i.e., increased if necessary).

The final version of the bundle offered on the company's website and tested as part of the field study was elaborated by the project team members (UNISG) and representatives of the company Plug'n Roll by Repower; namely, the e-mobility department (its head and product manager) and the sales department. Each party conducted preliminary analyses to see which components would be the most desirable by customers (Online study 1 by UNISG; results presented at the beginning of this section and in the respective sections of the document). We discussed and concluded on the final bundle offer at the meeting in December 2019. The project members then provided comments to the website draft (i.e., information to be presented, set-up of the website – which information comes first etc.). The company then finalized the offering throughout the month of January 2020 internally, upon exchanges between the e-mobility, sales and graphic departments. As mentioned above, the bundle offer was launched online in January 2020.

3.9.4. Findings – online survey

By the end of November 2020, the website of Plug'n Roll by Repower was visited by 1'676 consumers; the direct link to the bundle site was accessed by 1'269 people. Out of these consumers, three expressed an interest in the bundle, two of them requested the feasibility check to assess the capacity to install the private charging station at their private garage. One made an initial reservation, however did not proceed with the final purchase.

The online survey was responded by three consumers, one accessing it via the website of the Plug'n Roll by Repower and two at the Tag der Elektromobilität 2020. The findings are thus not statistically significant. However, the gathered observations have informative value that we want to further discuss. Firstly, the respondents were men in their 40s. The fact that mainly this socio-demographic group is to date interested in the bundle product and electric mobility as such in Switzerland was confirmed even during the interview with Plug'n Roll by Repower. The project leader confirmed that most of the consumers who express interest in their products are exactly in this socio-demographic group. The respondents who answered the survey at Tag der Elektromobilität were interested in an EV purchase, the customer answering directly online already had an EV. All three participants showed an interest in purchasing the bundle. The reasons were however very varied, ranging from the practicality of the offer and its capacity to limit to complexity of the EV purchase to encompassing more components than alternatives.

Second observation resulting from this online survey was that the bundle seems to have a positive impact on EV interest, with the mean of 5.66 (measured by 7-point Likert scale type question with 7 indicating the highest interest). However, this interest does not necessarily translate in EV purchase willingness, with the mean score of the three respondents being only 5. Finally, controlling for the perceived behavioral control of operating an EV did not reveal any important insights since it ranged from 3.29 to 7 (seven statements measured by 7-point Likert scale type question).

3.9.5. Findings – interviews

The interview conducted with Plug'n Roll by Repower revealed many important findings, complementary to the results of the online survey and beyond. Overall, the company perceives the field study very positively, with important insights learned for their business model and further strategy. They see the value in offering the bundle. While no consumer has purchased the bundle itself, the product increased the attention of the consumers to their offer in general. This resulted in number of other purchases, especially charging stations for community garages of apartment houses. Secondly, the bundle allowed number of new partnerships with car dealers and other actors to be launched that would not be thinkable before. The company profited from these partnerships in terms of additional product sales, such as charging station installations directly at the garages of the car dealers and ideas for further collaborations. In that, the company sees the product as a "Door opener", allowing for previously unknown and unthinkable collaborations and business opportunities.

Although no disadvantages were noted by the respondents answering the survey online, the interview with Plug'n Roll by Repower revealed that one of the biggest drawbacks of the offer can be its relatively high price. Investing a minimum of 3'333 CHF at the point of sale when purchasing an EV can be an already too high a share of the disposable income of many potentially interested customers. Second barrier observed by Plug'n Roll by Repower is the capacity to install the bundle at one's garage. Many consumers were actually not aware of the limited possibility to install a charging station in their garage until the feasibility check was conducted. As previously mentioned, these were however

positive experiences for the company since they resulted in a total of 5 charging station installations in community garages of apartment houses where the consumers live.

These observations lead the company to an important realization, namely the need to strengthen their focus on consumers without a private garage and with a lower disposable income. This broadening of the consumer base is more than sensible considering the increasing diffusion of electric mobility in the market and thus broader customer segments becoming potential EV adopters. Moreover, with 70% of Swiss citizens living in apartment buildings (Plug'nRoll, 2020b), it will be more and more relevant to provide solutions for charging also in community garages. Consequently, the company is considering developing an additional bundle type, focusing directly on community garage installation. The charging station included in this bundle offer would be possible to be rented, not necessarily only purchased.

Due to the limitations caused to the field study by COVID-19 pandemic, the company has decided to prolong the initial stage of the project by one year. Consequently, the company will continue offering the bundle in its current set-up for additional year and postpone its potential redesigning by one year to the end of 2021. In a similar vein, the company still hopes to be able to get more car dealers on board in 2021 and introduce the bundle at some of the hopefully still happening car fairs in spring 2021. Finally, pandemic has shown the company that they have to strengthen their online presence and communication. Yet, they believe that car sales will still primarily happen at salons of car dealers. Therefore, car dealers remain their main strategic partners and the company wants to continue strengthening the collaboration with them.

The interview with the car dealer who agreed on the cooperation with Plug'n Roll by Repower and started offering the bundle together with the EV at the point of sale confirm the above findings. Firstly, the car dealer agrees that the bundle increased the attention of customers to electric mobility, as a result of which the topic comes much more to discussion with them. What is however very interesting is that the car dealer mentioned that this happened mainly since they installed the charging station directly to the EV in the car salon. When only the mock product promotional stand was placed in the salon, the attention was not so high (the company Plug'n Roll by Repower is delivering to potential car dealers a stand that presents the mock-ups of the individual components of the bundle and the charging station). This observation goes in line with the others in the literature and the field that real experiences with electric mobility, for example on the platform of a test drive, are much more valuable than only general discussions (Bühler et al., 2014; EnergieSchweiz, 2019; St.Gallen, 2019; Tesla, 2019).

Secondly, the car dealer also confirmed the other observation of the Plug'n Roll representative, namely that the bundle serves as an information tool about charging not only to potential customers, but to car dealers themselves. The car dealer representatives admitted that customers are oftentimes more familiar with the necessary components for charging and EV operation than themselves. The bundle and the partnership thus launched thus offers a confidence boost to the car dealers, informing and providing them a responsible and relevant partner to whom to direct customers in case of questions or a need. This observation confirms other findings in the practice and theory pointing to the limited knowledge on the side of car dealers and the possibility that by raising the level of their knowledge, they might be more likely themselves to discuss electric mobility with potential customers (Cahill, Davies-Shawhyde, & Turrentine, 2014; de Rubens, Noel, & Sovacool, 2018; EM, 2019b). For that, however, trust in the partner and ideally local partnerships are desired. The car dealer interviewed very much valued that Plug'n Roll is a local partner with whom they have developed a good working relationship over the past years. This trust and experience then motivated them to launch the partnership and start offering the bundle in the first place. The importance of local partnerships might even increase in the future, with more solutions and cooperation happening on the local scale (Shepard, 2020).

The local nature of the partnership might however also represent one of the main hurdles to its future continuation or possibility to launch partnerships with other car dealers. As both interviews revealed, the prescriptions of the group and mother companies might impose restrictions on car dealers with which companies they can cooperate and thus which products they can offer. Compared to these products that can profit from economies of scale, the offer of Plug'n Roll is also more expensive and less technologically developed. As the car dealer illustrated, the promo stand of the product that they have received from the car brand they mainly sell is all digitalized, thus attracting even more attention by customers than the one delivered by Plug'n Roll by Repower. Thus, looking into the future, the cost, technical capacities and competition by mother companies might represent a main issue to the bundle offers provided by local partners such as the one tested in our field study.

3.9.6. Conclusions

The field study, despite the difficulties caused by COVID-19, has delivered important experiences and findings. First of all, it shows the complexities of new product development and market launch as such. A multitude of unexpected events can influence the planned progress, with the global pandemic representing one of the most extreme examples. This is also why implementation and trialing of products and solutions in practice is of a critical importance. Secondly, the field study confirmed the findings of the Online study 1, namely the potential effectiveness of the bundle to increase EV interest of customers. However, the effect on direct EV purchases and EV purchase willingness as such was limited. This confirms other findings in the literature that one intervention only might not be sufficient to translate into direct purchases. However, such measures are needed to be continuously raising awareness and assuring the potential consumers of the role of electric mobility, eventually translating in future purchases.

One of the main findings from the interviews is the observation of the project partner that a broader product offer focusing on providing charging solutions to community garages in apartment buildings is necessary. This shows the enlarging pool of consumers entering the market of electric mobility, no longer being homeowners only. Interviews with the project partner and the car dealer also confirmed our findings from previous studies, namely that car dealers themselves are to date rather lacking knowledge of electric vehicles, namely the complexities that come with charging. Consequently, the offer is not only important for consumers, but also for car dealers, providing them necessary information and a reliable partner to answer the demand and potential questions of customers. This can be critical to increase their confidence in discussing the product and thus potentially making them more likely to offer EVs, as also found out by our Preliminary study 1 (Plananska, 2020) and suggested elsewhere (Cahill et al., 2014; de Rubens et al., 2018). Thirdly, the interview with the car dealer provided an insight into the limitations of the offer, namely the competition posed by the mother companies and obligations of car dealers to offer certain products over the others. However, interviewees from both Plug'n Roll by Repower and the car dealer concluded on the positive impact of the partnership and the bundle offer, both for the companies as mentioned above and the consumers.

4. Conclusions

4.1. Scientific conclusions

The adoption of fuel-efficient vehicles is imperative to limit emissions from private transport and thus to contribute to fulfilling Swiss and global energy and climate goals (Boulouchos et al., 2017; Teter, 2020). Despite increasing engagement from the public and private sector (Lieven, 2015; McKerracher et al., 2020), the market share of fuel-efficient vehicles is growing only slowly and lags behind the set-targets (BFS, 2020; IEA, 2020b; UVEK et al., 2018). Consequently, alternative measures than implemented to date are needed to accelerate fuel-efficient car purchases.

Nudging and other choice architecture techniques represent an additional, complementary tool to traditional policy instruments that policy and other change makers can implement to promote sales of fuel-efficient vehicles. Famously coined in 2008 by Richard Thaler and Cass Sunstein, nudging techniques build on the insights from behavioral economics and psychology about the complexity of human decision making to promote public welfare (BIT, 2019b; Thaler & Sunstein, 2008). Although their effectiveness has been proven to motivate pro-environmental and pro-social behavior in other domains (Allcott & Kessler, 2019; Bohner & Schlüter, 2014; Bucher et al., 2016; Chassot et al., 2017; Münscher et al., 2016), investigation whether and to what extent nudges can be effective to promote fuel-efficient car purchases has still been missing.

Our research project aimed to address this gap in academia and practice. To this end, we combined a top-down and a bottom-up approach, combining an analysis of the existing theory and best-practice examples respectively. Based on this analysis, we identified a set of most promising nudging techniques for the car domain and empirically tested the identified nudges by the means of laboratory and online studies and a field study with an electric utility and selected car dealers. As such, we aimed to improve the already existing nudges, to make them more appropriate for application in the transport sector and to develop new ones to motivate fuel-efficient car purchases in Switzerland.

The preliminary analysis of the literature made us aware of the need to better understand the psychological processes driving consumer preferences for fuel-efficient vehicles. Consequently, we conducted two preliminary studies, one analyzing the vehicle purchase process and its determinants and the second focusing on consumer motives for fuel-efficient vehicles and alternative mobility options. The former study showed that the vehicle purchase process consists of five stages underlined by a plurality of decision-making strategies and is determined by number of external influences, among which the most important ones are car dealers. The research resulted in the development of a new, conceptual framework of the vehicle purchase process, illustrating touchpoints within its individual stages to motivate sales of electric vehicles in Switzerland. These touchpoints are fostering of the consultation of a plurality of specific information sources in the search stage, running EV training programs and making them obligatory for car dealers (effective mainly in the alternative evaluation stage) and investing in charging infrastructure, important especially for the post-purchase.

The results of the second preliminary study on mobility motives showed that differentiated motivations are at play for the adoption of various sustainable mobility options such as fuel-efficient vehicles. While environmental mobility motives drive consumer preferences for fuel-efficient cars, motives related to the representation of one's societal status drive the adoption of more polluting cars, such as SUVs. Another striking finding was that the influence of consumer habits in purchasing different mobility alternatives differed substantially across mobility options. Consumers' purchase intentions of an electric bike, a public transport ticket, and an SUV were strongly accounted for by currently owning one of the mobility alternatives. In contrast, purchase intentions of battery-electric, hybrid-electric, and fuel-efficient vehicles were not strongly accounted for by prior ownership. This finding suggests that

consumers do not get as much attached to a fuel-efficient combustion engine car as they do for more polluting SUVs or an annual public transport ticket (i.e., SBB General Abonnement). It remains to be seen if consumers develop habitual purchases of battery-electric and hybrid-electric vehicles, once these mobility options become more widely adopted. Based on this research, highlighting the satisfaction of environmental consumer motives and facilitating habit formation for the purchase of more fuel-efficient cars seems to be the most promising policy strategies at present.

Building on the insights from these two preliminary investigations and the bottom-up and top-down approach, we identified six promising nudging interventions to be tested in the context of fuel-efficient car purchases in Switzerland – namely bundling techniques, social norms, framing (past and future), communication of different consumption units, rank nudge and the activation of status roles. The selection of these nudges was based on the general effectiveness of the nudges, their applicability to the context of car purchases, their evaluability with our methodological means, and if they could provide clear recommendations to policy makers and practitioners. We then tested these identified nudges by the means of three laboratory, three online studies and one field study in collaboration with the electric utility Plug'n Roll by Repower. The objective of these studies was to empirically and practically investigate the potential and effectiveness of the nudging interventions to motivate fuel-efficient car purchases in Switzerland.

The first laboratory study investigated the effect of status activation and political ideology on preferences for environmental and luxurious car configurations. The results did not provide an evidence for either, status maintenance or status advancement activations in promoting preferences for fuel-efficient cars. Most likely, this was due to the very subtle activation of status motives, which was realised by a so-called "priming" task. Further research should look into different methods that assess the influence of status aspirations on the preference for more and less fuel-efficient cars using more explicit motive activation methods.

The second and third laboratory studies looked at the role of consumption units (e.g., litres fuel or kWh energy) on the evaluations of fuel-efficient cars. Across three studies we showed that the unit used to describe the fuel consumption influenced how the environmental image of cars is evaluated. Specifically, respondents were most sensitive in their evaluations when fuel consumption was presented in the default unit litres per 100 kilometres (compared to kWh, gallons, CO2 emissions, and annual fuel cost). This effect was driven by the familiarity of consumers with the different units. Consumers are more familiar with the unit litres per 100 km. As a result, they more strongly perceive differences in this unit than in units they are less familiar with such as kWh. Additionally, consumers reported to be willing to pay more for fuel-efficient cars, such as electric vehicles, when consumption was presented in a measure of litre fuel equivalence, in contrast to kWh. The presentation of consumption in kWh required participants to compare fuel-efficient cars and less efficient cars, from which consumers might want to switch, across different units. This cross-unit comparison, prevalent on most car energy labels around the world, reduced consumers' willingness to pay for fuel-efficient cars. Laboratory Study 3 followed-up on the insights from Laboratory Study 2 and was based on the hypothesis that consumers are most sensitive to environmental impact information when the unit at hand allows for easy mental ranking. Based on this assumption, we developed a rank measure of the environmental impact of cars which was based on the vehicles' consumption rank among all cars currently available on the market on a scale from 1 to 100. We subsequently compared consumer evaluations based on the newly developed rank unit to other commonly used units of environmental impact, such as litres per 100 kilometres and CO_2 emissions presented in g/km. Our results showed that when exposed to the newly developed rank unit (or "nudge"), consumers most strongly differentiated between the levels of environmental impact of cars. In comparison, consumers were somewhat less sensitive to differences in the environmental impact presented in litres per 100 kilometres and much less sensitive to differences presented in grams CO2 emissions per kilometre.

Taken together, the results from Laboratory Study 2 and 3 suggest that the units that are used to describe the consumption and the environmental impact of fuel-efficient cars should be chosen by policy makers to make the comparison and assessment by consumers as easy as possible, by considering the knowledge and familiarity with a unit on the consumer side.

The three online studies conducted as a part of the project also revealed very important findings. Firstly, we investigated the role of bundling on EV adoption intentions of Swiss consumers. Namely, by an online study combining a between-subject design experiment and a choice experiment (responded by 313 Swiss consumers) we analysed if bundles of EVs and charging services can be effective to increase EV purchase willingness of Swiss consumers and if yes, what the preferred set-up of the bundle would be for individual customer segments. The findings of the online study showed that bundling can be an effective strategy to increase EV purchase willingness of Swiss customers, however only of those with low pre-existing knowledge of EVs, especially about the perceived behavioural control of operating an EV. The effect of this convenience nudge significantly fades away with higher levels of prior EV related knowledge. Secondly, conducting a choice experiment, we identified three customer segments among the study respondents: (1) Tech-oriented adopters, (2) Convenience-oriented adopters, and (3) Likely non-adopters.

The second online study investigated the role of social norms on EV adoption intentions. The goal of the study was to investigate if social norms can be powerful nudging interventions to promote EV sales in Switzerland. If yes, we wanted to know which ones, i.e. whether descriptive dynamic, injunctive, or their combination, would be the most effective. Consequently we conducted an online between-subject design experiment, exposing respondents to four normative messages on (1) the recent growth of EV sales in Switzerland (descriptive dynamic), (2) the recent decline of ICE sales in Switzerland (descriptive dynamic), (3) the recent increased of the use #SUVShame on social media (injunctive), (4) the combination of the recent decline of ICE sales and the recent growth in the use #SUVShame on social media (combination of descriptive dynamic and injunctive). The #SUVShame has been especially popular at the beginning of 2020, resonating on social media (Twitter and Instagram) to show the disapproval of SUV cars since they are the major polluters within the transport sector (Cozzi & Petropoulos, 2019). Its use echoes the even more popular #FlightShame, trending with the increasing role of climate protests and the need to limit this highly polluting mode of transport (Irfan, 2019).

The results of the study showed that social norms have to date an only a limited effect in motivating EV purchases in Switzerland. However, their effect was moderated by the perceived credibility and familiarity with the norm. Respondents who found the communicated message credible and liked #SUVShame expressed a significantly larger EV purchase willingness than respondents who did not believe or did not like the communicated message. We however also observed adverse effects of social norms communication. Consumers who did not believe the dynamic descriptive norm on the recent growth of EV sales demonstrated a significantly lower EV purchase willingness than the control group.

The third online study analysed the impact of message framing on the support for additional state subsidies of electric mobility. Specifically, the participants of an online study were presented with the same message proposing a subsidy for electric mobility framed as either future or past oriented. In public debates, the necessity for regulations protecting the environment are most often motivated by a progressive vision of a better future state of our environment. However, an alternative way of motivating the very same regulations could be a vision of returning the environment to its better past state, which can be expected to increase support by more conservative citizens. We found that the political affiliation of the respondents and the perceived political affiliation of the promoter of the policy interacted to form policy support. Political conservatives more strongly preferred the policy when they

perceived the policy to be promoted by a politically conservative representative, and liberals more strongly preferred the policy when they perceived it be promoted from a politically liberal representative. Importantly, perceived political conservatism was independently shaped by both, past-framing of the article and conservative party affiliation of the messenger. Past framing used by a politically neutral messenger or a liberal party member, however, was not sufficient to significantly increase policy support by conservatives. These insights stress the importance of *who* communicates *how* to target different political segments of the society to promote broad support of electric mobility, and the adoption of fuel-efficient cars more general. Electric mobility seems to be a topic where citizens and consumers are not very knowledgeable and confident about their judgments. Hence, they more strongly rely on opinions of their political leaders, which should communicate based on state-of-the-art insights from science and in a way that speaks to the value structure of both, liberals and conservatives by making reference both to the future and the past.

The goal of the field study was to test in practice the findings of the Online study 1, namely the effectiveness of the bundle of EV and charging services on real purchase behaviour. COVID-19 severely limited the scope of the studies that could have been conducted, resulting in no statistically significant results. Nevertheless, interesting facts were observed. Firstly, the online survey (responded by three Swiss consumers) and the interviews with the project partner and the collaborating car dealer confirmed the positive effect of the bundle in numerous ways - by increasing the EV interest of consumers, helping them overcome the complexity of potential EV purchase, raising awareness and knowledge of EVs and charging services for both consumers and car dealers and offering new business opportunities to the electric utility initiating it. Secondly, the positive side-effects of the bundle observed by the project partner show that a new product offering, even if it does not fulfil its original purpose, can open up avenues for new business opportunities. In this case it highlighted the need to focus on the growing segment of customers with lower disposable income living in apartment houses without a private garage to install a private charging station in. Consequently, the project partner is thinking to develop a new bundle offering for community garage spaces. Its components could be rented by the customers, which would decrease the costs of the bundle and thus would make it potentially more desirable for broader customer groups. Finally, the interview with the car dealer revealed the growing competition posed by the mother companies. They start offering bundles of EVs and charging services themselves and oblige car dealers to offer certain product lines without their power to choose the products to offer themselves.

4.2. Recommendations to policy makers – Application of nudges to promote fuel-efficient car purchases in Switzerland

The findings of our research project have important implications for Swiss policy makers and other actors aiming to promote private fuel-efficient mobility in Switzerland. The first preliminary study showed that policy makers have to be aware of the complexity of the decision-making process consumers go through when purchasing a car. To make their interventions effective, policy makers have to know which stage of the vehicle purchase process and which target group they want to address. The paper resulting from the first preliminary study suggests three concrete interventions within the so-called “touchpoints”, identified points of interaction between the consumers and the product. These are namely fostering the consultation of a plurality of information sources, making EV training programs obligatory for car dealers who want to operate in the designated territory and investing in charging infrastructure. Besides these concrete recommendations, the paper provides a very good navigation for policy makers how to set-up their interventions within every stage of the vehicle purchase process. It offers a set of navigating questions how to develop strategies relative to

any of the five vehicle purchase process stages (for more details see Table 1 of the Plananska 2020 paper).

Preliminary study 2 showed that a plurality of motives, next to socio-demographic data, determine purchase intentions of fuel-efficient mobility alternatives. Important consumer mobility motives were environmental, status, finances, independence, safety and hedonism motives. These results point out to Swiss policy makers and any marketers trying to promote fuel-efficient mobility that they have to consider the plurality of motives and consumer segments in their strategies. Current customers of fuel-efficient vehicles begin to extend beyond the first, tech oriented, mostly young male innovators (Hardman, Shiu, & Steinberger-Wilckens, 2016). To effectively reach new, emerging consumer segments that cannot be easily characterized with a specific set of demographics, the satisfaction of the most important consumer mobility motives, especially the environmental motive, should be in the center of attention of policy makers and practitioners. Very importantly, potential nudging interventions leveraging different mobility motives should take into account that motives play a varying role for different mobility options in a multi-model world of transportations.

Laboratory studies 2 and 3 investigated a different topic, namely the role of different units on the perception of the environmental impact of fuel-efficient cars and the resulting preference for different technologies. The finding that liters per 100 kilometers, the default unit for energy consumption, was the most effective unit to drive preferences for electric vehicles, right after the newly developed rank nudge (i.e., putting the concrete vehicle in the context of the environmental performance of all other cars on the market) have direct implications for policy makers. Specifically, these two preferred units can be included in the energy label for cars. Most importantly, the energy consumption of electric cars, to date expressed in kWh per 100km driven, can be easily replaced by its translation to liters per 100km driven. Not familiar with the unit of kWh, people tend to underestimate the environmental potential of fuel-efficient and especially electric vehicles under the current unit expression. Given the early stage of our research on the rank nudge, we currently recommend the implementation of the default unit liters over the implementation of a rank unit. Although the results of the rank nudge seem promising and build on a strong theoretical foundation (i.e., rank-based decision making; Stewart, Chater, & Brown, 2006), we have only identified its superiority over a fuel-equivalence measure in one online experiment with a somewhat restricted sample (German car drivers). We consider that this finding needs further empirical support in order to allow for a clear policy recommendation.

Online study 1 supports the idea that bundling of EVs and charging services is an effective strategy to promote EV purchases in Switzerland, especially among forthcoming adopters. The customer segmentation shows the importance of differentiated, customer targeted bundling strategies. We see that a substantial part of adopters (22.0%) prefers the currently offered, narrow bundle of EV and charging services only. This provides an encouragement to practitioners to continue in this marketing strategy, at least in the short-to mid-term. The largest segment in our study that represented 55.9% of respondents, however, prefers a broad bundle including besides charging also additional services such as insurance, battery assistance and green electricity certificate. We refer to them as *Convenience-oriented adopters* and we suggest practitioners focusing especially on them, i.e., developing in particular this bundle type. With the growing convenience-orientation of wider adopter groups (Rogers, 2003), this marketing strategy will become even more relevant in the future.

The field study confirmed and further built on the findings of the Online study 1. We would thus recommend industry players, both car dealers and electric utilities, to include bundling strategies, especially the bundle tested in the Field study, in their offering. While not translating into direct sales, the online survey encompassing three respondents showed that this bundle had a positive impact in both increasing the interest and attention of potential customers. This can translate into purchase at the later point in time, when a sufficient number of inputs is accumulated. Secondly, the interviews with

the partnering electric utility and the car dealer revealed that the bundle offer also increases the knowledge of charging components of the car dealers themselves. The bundle thus helps to overcome one of the major remaining bottlenecks to EV sales to date (Kester, 2018; Plananska, 2020). We also suggest including the bundle in the portfolio since it offers number of new business opportunities and helps launch new partnerships across different fields. The role of partnerships of previously diverse actors is especially important for the electric mobility sector in which previously unrelated fields come together (Cherubini, Iasevoli, & Michelini, 2015). Finally, based on the findings from the interview with the project partner Plug'n Roll by Repower we would also recommend diversifying the bundle offer itself by offering a version for community garages and including a rental version. Focusing on customers who do not own a private garage or who do not have the disposable income to make large investment at the point of sale (since the private charging station is to date still relatively expensive) would become even more relevant in the next stages of EV diffusion since broader consumer segments will be entering the market. Such offers will also need to catch up (in terms of price and technology) with the ones provided by car manufacturers themselves to remain competitive on the market.

Online study 2 investigated the role of social norms on EV purchase willingness. The identified limited role of social norms to date on EV purchase willingness illustrates that electric mobility is within the Swiss population not yet an established norm. However, we observed important mechanisms at play, namely the credibility and familiarity with the communicated message. This finding has two major implications for Swiss policy makers and their communication strategies aiming to promote fuel-efficient vehicles in Switzerland. First, communication strategies should be set-up in a way credible, i.e. believable, to consumers. Communicating in a way that would not be believable is not only ineffective, it can also be counterproductive. As we showed, when respondents were exposed to the norm that they did not find credible, they reported an even lower EV purchase willingness than the control group. These adverse effects thus raise an important reminder to change makers promoting fuel-efficient mobility in Switzerland that the communication has to be well thought through before implementation to prevent potential unintended consequences. To do so, we recommend conducting randomized control trials (RCTs) and empirically test the intended interventions before their full launch within population (Banerjee & Duflo, 2009; BIT, 2020; Kendall, 2003). Second, the study also showed that social norms need time to build up and develop. Consequently, while not yet immediately effective, Swiss policy makers could try to contribute to the generation of new norms by communicating the importance and support of fuel-efficient mobility, for example by contributing to the online trend of #SUVShame on social media. Touching upon the topic of social media, this research also shows that Swiss policy makers should more actively communicate on the individual channels (Twitter, Facebook etc.) to grasp and support the trends emerging on these platforms that can materialize in a new norm generation.

Finally, Online study 3 highlighted the role of the messenger and the impact of framing of political messages on their reception. A past framing was effective in obtaining the support of more conservative citizens for a subsidy of electric vehicles only when communicated by a conservative party member. It remains thus crucial to win support for climate mitigation policies by representatives of the entire political spectrum that exert an important influence on the preferences of their respective partisans. While we cannot recommend past-framing as a generally effective tool for policy making, it may allow representatives of more conservative political parties to achieve additional support for environmental policies.

In summary, the evidence collected in the present project suggests that nudging interventions in the context of fuel-efficient car purchases can be an effective tool to complement more traditional policy measures, such as regulations or financial incentives. The nudging interventions tested here were shown to be effective in increasing important behavioural outcomes, such as consumers' product

evaluations, willingness to pay, hypothetical choices, and electric mobility policy support. This evidence is in line with the general effectiveness of nudging interventions in other domains, and the results of our meta-analysis (Mertens et al., forthcoming; Münscher et al., 2016). Additionally, our evidence confirms that nudging interventions can be successfully developed, transferred to, and revised in the context of fuel-efficient car purchases.

Although the scientific methodology applied in the present project allowed for a very controlled testing of the nudging interventions, resulting in reliable results, highly controlled tests come at the price of limited generalizability. In reality, multiple contextual and motivational factors interact to form consumers' decision to purchase a fuel-efficient car – as we have observed in the conducted field study, which was severely impacted by a multitude of unexpected events. Thus, it is essential that the nudges shown to be effective here in an experimental set-up are tested in more applied contexts to get a reliable estimate of how their effectiveness relates to other influencing factors. Based on the effective testing of the unit effect, the rank nudge, social norms, product bundling, and framing, our research provides an important starting point of field tests of the nudging interventions tested here. Especially on the side of policy making, a habit of running field tests in collaboration with researchers, in the spirit of evidence-based policy making, has yet to develop in many places. Only evidence-based policy making through systematic field tests allows for a clear understanding of the effectiveness of nudging interventions complementing traditional policy measures in a given context such as fuel-efficient car purchases (Banerjee & Duflo, 2009; BIT, 2020; Loewenstein & Chater, 2017).

5. Outlook and next steps

The results of our research project are very extensive, bringing important contributions to both academia and practice. At the same time, they open up avenues and ideas for further research and further elaboration by both academia and practice.

From the unit effect and the rank nudge laboratory studies it follows that the information about the consumption of fuel-efficient cars and the environmental impact of vehicles in general should be made a topic in future revisions of the Swiss car energy label. From a research perspective, a comprehensive assessment of the information presented on the car energy label that simultaneously considers different components, and also addresses the question of how much information is necessary, and which information might be too much. With an even broader perspective, the role of car energy labels in comparison with other influencing factors, such as the role of car dealers (Plananska, 2020), should be investigated. Finally, interventions that might increase the weight that consumers put on energy labels in their car purchase decisions should be developed and tested.

In terms of the online and field study analyzing the role of bundling on EV purchases, we can firstly suggest that the bundle identified as the most effective to promote EV purchase willingness among convenience-oriented adopters be developed and tested in practice. Such a bundle should include not only components necessary for charging (such as private charging station and its installation and access to public charging station), but also additional components relevant to EV driving, such as green electricity certificate, insurance and battery assistance, all in the preferred levels as shown in the results of the Online study 1. The results of the testing of the currently developed bundle by the project partner Plug'n Roll by Repower on the platform of the ongoing field study have been to date only limited due to the COVID-19 pandemic. Consequently, the company has decided to run the test in the field study conditions one additional year before its full assessment. Nevertheless, based on the existing data, we already see a potential follow-up study and test of a yet broader portfolio of bundles,

namely ones suitable for community garages and bundles possible to be leased by the consumer. Another suggestion is to bundle the charging station with the car and provide one joint price for the combined offer.

The studies of social norms, as well as the political ideology and past framing nudge indicate that citizens' attitudes and intentions with regard to the adoption of fuel-efficient cars are embedded in societal dynamics. The way representatives from policy and industry communicate about the topic of fuel-efficient cars has important influences on how the topic is perceived by the broader public. This means that representatives have to be made aware of the influence they have, by for example communicating an increasing trend in electric vehicle adoption (dynamic social norms) or by referring to electric mobility as already having been a subject in the past (past framing) when stressing the importance of adopting fuel-efficient cars to meet climate objectives. It would be important to investigate to what extent representatives are already aware about the influence of the language they use on citizens' attitudes and intentions to adopt fuel-efficient vehicles. In a second step, training representatives to speak about fuel-efficient car adoption in ways that increase citizens' preference – i.e., in a credible, familiar and past-oriented way, would be a promising application of the present research results. The communication strategies might need to vary vis-à-vis individual groups of society. Policy makers would need to understand how to distinguish them and flexibly change the frame based on the audience they want to address. Additionally, winning representatives of less environmentally concerned groups, such as political conservatives, to promote electric mobility would be also an important lever to increase fuel-efficient car purchases across all levels of society.

The issue of insufficient adoption of fuel-efficient vehicles in order to meet energy and climate goals is far from being solved; CO_2 emissions of transportation continue to increase, globally and in Switzerland. The exceptional decline of transport emissions in 2020 (in Switzerland of approximately 10%) due to COVID-19 pandemic will most likely not persist once the restrictions are lifted. The potential of fuel-efficient vehicles to contribute to low carbon mobility has unfortunately not been fully tapped. One way to do so is by considering the insights from behavioural science that understand human behaviour as influenced by not only rational, but also a plurality of emotional, cultural and wider contextual factors. Incorporating these insights into policy making to promote human welfare is however still novel, only slowly entering the field of environmental action and, even less so, fuel-efficient car adoption. Much remains to be done by researchers, policy makers and the industry. The present research project is an example of how effective interventions can be identified in a joint effort to bring these three key stakeholders closer together in fighting climate change. While there is a tradition of making relevant topics in policy making a subject of research, the link of research results feeding back to evidence-based policy making is more recent. Examples from other countries (e.g., The Behavioral Insights Team, UK) (BIT, 2019a) show that there is a considerable potential in extending the idea of the present project to a larger scale and to thereby improve the effectiveness of policy making targeting climate action and other relevant societal issues.

6. National and international cooperation

Plug'n Roll by Repower AG – Swiss electric utility with headquarters in Graubünden. Cooperation on the Online Study 1 and the Field Study. The company developed a bundle of charging services (private charging station and its installation, access to public charging network with a pre-paid credit

and a green electricity certificate) that was analysed in Online study 1. The bundle was then tested in practice by the means of the Field study, in which the aim was to collaborate with selected car dealers to sell the bundle together with the EV at the point of sale in the car salon. Despite the large limiting effect of COVID-19 on the capacity to proceed with the field study, important findings were gathered, which are reported in the respective section of the report.

Consumer Barometer of Renewable Energy (KUBA), 2020 – an annual survey of renewable energy preferences of Swiss consumers run by the Institute for Economy and the Environment of the University of St.Gallen (IWÖ-HSG). The online study 2 (the role of social norms) was conducted in collaboration with the panel. Namely, the between-subject design experiment was inserted into the annual survey, run in January 2020. This collaboration assured that a sufficient amount of respondents participated in the study. The results of this collaboration are reported in the academic paper currently under preparation and reported in the respective section of the report.

SCCER CREST and SCCER Mobility – the research teams and thus the project is also part of the activities of the SCCER CREST and SCCER Mobility research competence centres that are spearheaded by Innosuisse, the Swiss Innovation Agency.

7. Communication and Publications

Communication of findings and result dissemination is an inherent part of academic work. It should however not only target the scientific community via academic articles and presentations at academic conferences. The goal of science should also be to also communicate its findings to a larger audience, be it via more accessible style of publications or direct engagement with the audience by the contribution to popular media outlets (journals, magazines, social media) and engaging in a dialogue with broad audience. An increasingly important format is also online conferencing and webinars. Thanks to their accessibility, they allow the scientific work to have an even bigger outreach to a broader audience.

In line with the role of science for communication as outlined above, our goal was likewise an active communication and dissemination of our findings throughout the duration of the whole research project. Besides the individual scientific publications resulting from empirical studies that are referenced above, we have actively communicated our findings via a plurality of channels, ranging from presentations at academic and industry-lead conferences to webinars and communication on general media channels. Table 6 lists all the dissemination activities divided by audience (scientific versus outreach activities) and the study referenced in the activity.

Table 6: Dissemination of the project results.

Scientific presentations – academia and industry	Study
Plananska, J. (2020). *Polarised and motivated? Using the Credibility of Social Norms and their Relation to Pre-Exiting Attitudes to Increase EV Customer Acceptance in Switzerland.* Panel presentation at the Behavior, Energy & Climate Change Conference. (BECC), December 8, 2020 (Online). Link: https://beccconference.org	Online study 2
Herberz, M., & Plananska, J. (2020). *Applying nudging techniques to promote fuel efficient car purchases*. Swiss federal energy research conference, November 20, 2020 (Online).	Project presentation
Plananska, J. (2020). *Touchpoints for e-mobility: Understanding the vehicle purchase process to promote EV sales in Switzerland*. Podium Presentation, Scientific and Technical Session 2 – Zero emission mobility. Transport Research Arena (TRA) 2020; Helsinki, Finland, April 27, 2020. (Conference cancelled due to COVID-19). Link: https://traconference.eu/programme/scientific-and-technical-sessions/scientific-and-technical-sessions-monday-27-april/	Preliminary study 1
Plananska, J. (2019). *Touchpoints for e-mobility: Vehicle Purchase Process Understanding for a More Efficient Promotion of Electric Vehicles*. Panel presentation at the Behavior, Energy & Climate Change Conference (BECC); Sacramento, California, USA, November 20, 2019. Link: https://www.alexandria.unisg.ch/258476/	Preliminary study 1
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2019). *Harnessing evaluability to promote alternative fuel vehicles,* Poster presentation at Society for Judgment and Decision making conference, Montréal (Canada), November 3, 2019.	Laboratory Study 3
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2019). *Choice architecture in environmental car choices: Unit familiarity increases sensitivity to attribute differences.* Panel presentation at International Conference for Environmental Psychology, Plymouth, September 7, 2019.	Laboratory Study 2
Plananska, J. (2019). *Touchpoints for e-mobility: Understanding the vehicle purchase process to more efficiently promote electric vehicles in Switzerland*. Poster presentation at the SCCER Mobility Annual Conference, September 6, 2019. Link: https://www.alexandria.unisg.ch/258476/	Preliminary study 1
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2019). *Choice architecture in environmental car choices: Unit familiarity increases sensitivity to attribute differences.* Panel presentation at Subjective Probability and Utility in Decision Making conference, Amsterdam, August 18, 2019.	Laboratory Study 2
Gamma, K., & Plananska, J. (2019). *Touchpoints for e-mobility*, Co-organisation of the conference workshop, REMForum 2019, May 24, 2019.	Preliminary study 1

Link: https://www.remforum.ch/fileadmin/remforum/review/2019/PDFs/_REMforum_2019_Programm_FINAL_updated.pdf	
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2019). *Unit familiarity leads to higher sensitivity to attribute differences: An application to attribute translation of car consumption.* Panel presentation at TEAP conference, London, April 4, 2019.	Laboratory Study 2
Plananska, J. (2019). *Customer acceptance of electric mobility: Vehicle purchase process understanding for a more efficient EV promotion in Switzerland*. Webinar, Young Talent Development Webinar Series, SCCER Mobility, March 14, 2019. Link: https://www.sccer-mobility.ch/p_supporting_measures/Young-Talent-Development/YTD-seminar-series-spring-2019/	Preliminary study 1
Plananska, J., Gamma, K, & Wüstenhagen, R. (2018). *Applying nudging techniques to promote fuel-efficient car purchases – State of the field analysis.* Poster presentation at the SCCER CREST annual conference, September 12, 2018. Link: https://www.sccer-crest.ch/news-events-publications/events/past-events/sccer-crest-annual-conference-2018/	Project presentation
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2018). *The influence of consumption unit (liter vs kWh) on the perceived environmental image of cars.* Poster presentation at the SCCER CREST annual conference, September 12, 2018. Link: https://www.sccer-crest.ch/news-events-publications/events/past-events/sccer-crest-annual-conference-2018/	Laboratory Study 2
Plananska, J., Gamma, K, & Wüstenhagen, R. (2018). *Applying nudging techniques to promote fuel-efficient car purchases – State of the field analysis.* Poster presentation at the SCCER Mobility annual conference, September 11, 2018. Link: https://www.sccer-mobility.ch/export/sites/sccer-mobility/p_supporting_measures/Annual-Conferences/AC2018/dwn_AC18/55_B2_Plananska_Gamma_Wustenhagen_Fuel-efficient-car-purchases-nudging-techniques.pdf	Project presentation
Herberz, M., Hahnel, U.J.J., & Brosch, T. (2018). *The influence of consumption unit (liter vs kWh) on the perceived environmental image of cars.* Poster presentation at the SCCER Mobility annual conference, September 11, 2018. Link: https://www.sccer-mobility.ch/export/sites/sccer-mobility/p_supporting_measures/Annual-Conferences/AC2018/dwn_AC18/55_B2_Plananska_Gamma_Wustenhagen_Fuel-efficient-car-purchases-nudging-techniques.pdf	Laboratory Study 2
Gamma, K., & Plananska, J. (2019). *Nudging consumers towards electric mobility.* Co-organisation of the conference workshop, REMForum 2018, June 1, 2018. Link:https://www.remforum.ch/fileadmin/remforum/review/2018/programm/REMforum_Programm_onsite_2018_FINAL.pdf	Project presentation

Outreach activities

Plananska, J., & Dällenbach, N. (2020). *The role of product bundling to electrify post-COVID-19 urban transport*. Organisation of the conference workshop, REMForum 2020, September 25, 2020. (Online). Link: https://www.remforum.ch/overview/programme/ Recording available on IWÖ YouTube Channel: https://www.youtube.com/watch?v=y_zBXnupsGw	Online study 1
Herberz (2020). *Wie viel ist ein Kilogramm CO2? Wie psychologisch fundierte Kommunikation unser Verständnis von Umweltauswirkungen verbessern kann.* InMind Magazin, 2/2020. Link: https://de.in-mind.org/article/wie-viel-ist-ein-kilogramm-co2-wie-psychologisch-fundierte-kommunikation-unser-verstaendnis	Laboratory Study 3
Häne, S, & Poletti, G. (2019). *Autohändler bieten nur selten Elektroautos an.* Newspaper article with a contribution by Wüstenhagen, R., & Plananska, J., Tages Anzeiger, Berner Zeitung, Basler Zeitung; April 2, 2019. Link: https://www.tagesanzeiger.ch/schweiz/standard/autohaendler-bieten-nur-selten-elektroautos-an/story/28524014	Preliminary study 1

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