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Cognitive Psychology

COVID-19 and the Perceived Dangerousness of Everyday Objects: A Behavioural Online Study in Italy and Germany

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The outbreak of COVID-19 and efforts to contain it have likely impacted our daily lives, including how we interact with objects. This online study aimed to develop and test a task to measure how different contexts affect our perception of objects, particularly those that were regarded as potentially dangerous. Two pre-registered experiments conducted in Italy and Germany showed how linguistically processed affordances (e.g., nouns) referring to objects perceived as dangerous (such as a door handle during the pandemic) were processed differently than those referring to neutral objects (like a toothbrush) in a sensibility judgement task. This effect was observed across different contexts and in both experiments. Further research is needed to determine if this effect is similar to the processing of negative words, and if it differs between objects with immanent negative properties (like a broken glass or a fire) versus those with potentially negative properties that only emerge in certain contexts. Replications of the study may clarify if the effect was temporary or produced more permanent changes in behaviour.

Introduction

The recent spread of COVID-19 and the measures taken to contain the disease have undoubtedly changed our everyday life. Most discussions correctly focus on the epidemiological aspects of the outbreak, and the impact of the pandemic and the containment measures on the psychological state and social life of individuals. However, the quick spread of COVID-19 and of the pervasiveness of the measures to contrast it has probably affected our everyday life also in a more subtle manner, i.e. influencing our interaction with everyday objects and our perception of their dangerousness. However, questionnaires might not be the most suitable tool to investigate this issue, as they require explicit judgments.

To this aim, we thus designed a simple online task that builds on existing literature on affordances intending to investigate whether and how objects that in normal conditions offer affordances, i.e., elicit reaching and grasping movements, are now perceived as potentially dangerous items that it is better to avoid or handle with extreme care.

Affordances. The notion of affordance, initially introduced by Gibson (1979), has received a lot of attention in the last years, especially in the framework of embodied and grounded theories of cognition. Based on Gibson's proposal, Ellis and Tucker (2000) first introduced the notion of micro-affordances, i.e., components related to specific movements, for instance reaching and grasping, that are elicited in relation to objects, and that re-enact brain patterns of visuomotor associations. In the last twenty years, several studies have provided data in support of this view. Behavioural evidence has shown that observing object affordances facilitates motor responses (for reviews, see (Borghi & Riggio, 2015; Thill et al., 2013): for example, observing a real or depicted cherry could facilitate a precision rather than a power grip response while observing a picture of a cup could facilitate a response toward its handle (Tucker & Ellis, 1998, 2004). There is evidence that several object properties such as shape, orientation, size, weight, and consistency influence motor responses to objects. Importantly, while the first studies in this field have reported an automatic activation of affordances, regardless of the current context and task, more recent work has rather shown that affordances are flexibly activated depending on the context and the object type (Borghi et al., 2012; Godard et al., 2019; Kalénine et al., 2014; van Elk et al., 2014). Consider, for example, an object with multiple grasping affordances, such as a fork: it will evoke a precision grip vs. a

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power grip when the context requires, respectively, its use or the action of moving it.

Dangerous affordances. Some recent studies have also addressed the affordances that might be specifically evoked by dangerous objects such as broken lamps, cactuses, and blades. Behavioural evidence has shown different responses to dangerous and neutral objects (Anelli et al., 2012). In a line bisection task with dangerous and neutral objects as flankers, participants consistently misperceived the line midpoint away from the dangerous objects (Anelli, Nicoletti, et al., 2013). When images of objects moved toward or away from participants, and participants had time to prepare their responses, those to the most dangerous objects were the fastest (Anelli, Ranzini, et al., 2013); when they were allowed no time to respond, instead, their answers to the most dangerous objects were the slowest. These results were interpreted as the evidence for an immediate freezing effect followed by faster responses when there is time for response preparation.

Overall, studies on object affordances show that graspable dangerous objects can elicit aversive affordances, thus evoking the tendency to escape them, and can lead to longer processing times. The mechanisms underlying the processing of dangerous objects, however, have yet to be fully unveiled: they could be either due to motor inhibition of the planned reaching-grasping action, to a freezing effect, or the evaluation of danger, as suggested by recent ERP studies (Cao et al., 2020; Liu et al., 2017).

Affordances and words. In the present online study, we investigated object affordances expressed through words. This is based on the assumption that, if objects activate affordances, then these affordances should be activated also by the words that refer to them. Experiments with single words have revealed that we are sensitive to the affordances of objects referred to by words. Myung and colleagues (Myung et al., 2006) have shown that participants are sensitive to the manipulability of objects in a lexical decision task: for example, the word "typewriter" is more facilitated when preceded by the word "piano" than by the word "blanket", even though both piano and blanket are equally associated to a typewriter. Tucker and Ellis (2004) found with both pictures and words a compatibility effect between the grip elicited by the objects (precision vs. power) and the motor response required to determine whether they were artifacts or natural objects. Other studies employing a mouse tracker device confirmed such effect for pictures, while compatibility was limited to natural objects in the case of words (Flumini et al., 2015). Overall, available results show that participants are sensitive to object size not only for pictures but also for words. Ferri and colleagues (Ferri et al., 2011) presented participants with object names, and asked them to decide whether they corresponded to 3D pictures; they found a compatibility effect between the grip and the object size. Differently from a task with 3D pictures, however, the effect was not modulated by the (near vs. far) position of the object in space. Bub et al. (2018) presented participants with image primes of objects in a canonical or rotated orientation, followed by a hand cue directing the subject to make a specific reach-and-grasp response which might be congruent/incongruent and aligned/misaligned with it. In a modified task, image primes were then substituted by words. A correspondence effect appeared with both images and words but following a different time course: it was present only among longer response times and it increased with time when words were presented, while it occurred earlier and was more constant for images. Marino et al. (2014) reported slower responses to pictures of graspable natural objects and the corresponding nouns (e.g., leaves) than to non-graspable ones (e.g., desert). More recently, Foerster et al. (2020) used immersive virtual reality to show that learning new labels for novel objects strengthens the ability to respond to their affordances and use them.

In sum, previous studies have shown that the effect of affordances is present not only with real objects and images but also with words (see for a critical view, Zeelenberg & Pecher, 2016). In the latter case, consistent effects are observed even with single words, although weaker than those obtained with pictures and real objects.

Interestingly, affordance effects with words are more clearly detected when stimuli are embedded within sentences. In a seminal study, Glenberg and Robertson (2000) demonstrated that sentences were evaluated as more sensible when participants were shown nouns of objects with the right affordances: for example, they selected as more sensible the use of a newspaper, compared with a matchbook, to protect one's face from the wind. This result suggests that constructing the meaning of object-related sentences consists in deriving affordances and meshing them under the guidance of syntax (see also Glenberg et al., 2009). Some studies have shown that affordances influence sentence comprehension. For example, Apel et al. (2012) demonstrated that the affordances of objects with handles influenced the span of acoustically presented instructions. More crucially to us, much evidence has demonstrated that during sentence comprehension we represent important object properties, such as shape and orientation (Pecher et al., 2009), and that we derive object affordances. For example, when participants are presented with sentences including an action verb followed by a noun (e.g., look at/grasp the brush) they prepare the motor grip adequate to grasp the mentioned object, while this does not occur with observation verbs (Borghi & Riggio, 2009). By recording responses with a manipulandum, Bub et al. (2018) showed that sentences describing a physical interaction (e.g., "kicking the calculator") not involving the hand primed volumetric as well as functional actions with a manipulable object. Importantly, object-related motor effects can be both linked to the stored representation of objects and the current context, linguistically expressed through a cover story (Cosentino et al., 2017): for example, we generally represent objects and entities as close to us, and in front of us, but when prompted by the linguistic context we might be able to represent them far away, and from the back (Borghi & Barsalou, 2019).

Perspective. The explicit presence of an agent might be crucial to the activation of object affordances when object nouns are embedded in sentences that include the descrip-

tion of an action (e.g., action-related sentences) such as "You kicked the ball" rather than "kicking the ball". Previous studies have indeed shown that processing action-related sentences using linguistic pronouns referring to the first/second person (e.g., "You") systematically elicits stronger motor engagement compared to the use of third-person pronouns (e.g., "She"; for a review, see Gianelli, 2018). However, how this relates to the activation of object affordances – and particularly those of dangerous ones – was to date not fully investigated.

In the context of the present study, this aspect is particularly relevant as the degree of engagement might affect the extent to which dangerous affordances are activated.

Based on the aforementioned literature, we aimed to assess the same set of hypotheses in two separate online experiments on Italian and German participants.

First, we tested whether objects that in normal conditions evoke affordances and facilitate our motor actions are now perceived as dangerous (thus possibly interfering with previous motor planning) compared to objects whose status has not changed. For instance, the handle of the entrance door to our building and a toothbrush would similarly afford a grasping action in normal conditions. However, the former might now generate a response inhibition because of its perceived dangerousness. We predicted that this would not be the case for objects which, being typically used individually (e.g., toothbrush, cup), should be perceived as more neutral and safer. We hypothesized that a conflict could occur between the affordances typically generated by objects such as the handle and the constant reminders we nowadays receive towards potential contaminations (Borghi, 2018; Cisek, 2007), resulting in overall slower reaction times for Dangerous objects compared to Neutral ones (Hypothesis 1).

To this purpose, we presented written sentences describing actions involving Dangerous vs. Neutral objects (e.g., "You grasp the handle" vs. "You grasp the toothbrush"). Participants judged whether each of these actions was possible or impossible with button presses, and response times were measured. The use of action-related sentences was instrumental to the activation of affordances, as effects with words are more clearly detected when stimuli are embedded within sentences ("You grasp the toothbrush") rather than presented in isolation ("toothbrush", see above). To this purpose, all sentences described hand actions with no manipulation of verb type. The use of an action evaluation task assured that participants carefully processed the content of each sentence, favouring the activation of object affordances. In this task, participants were required to evaluate each sentence in itself, without taking into account the relationship between the sentence and the cover story (scenario). This is a well-established task in the literature on affordances and directly pinpoints to the activation of object affordances and related possible and impossible actions. The advantage of using this task in the present context is that it allowed us to investigate whether and to what extent nouns affording actions automatically evoked a corresponding motor response, or whether this motor response was different (i.e., slower) when objects were perceived as potential sources of danger (e.g., a handle compared to a toothbrush). This result is theoretically relevant because it could contribute to understanding whether and to what extent the current situation influences the activation of affordances. For example, differently from a pistol or a cactus, a handle is not typically perceived as dangerous, and perceivable cues of dangerousness (e.g., thorns) are not present. However, it can turn into a potential source of danger in the current situation (e.g., when other people touch it after sneezing or coughing).

Second, we aimed to assess whether participants were sensitive to the distinction between Public contexts where the infection could more easily spread and Private contexts that are usually perceived as safer. To this purpose, the aforementioned sentences were preceded by cover stories describing daily Private and Public Scenarios. Recent evidence has shown that the perspective induced by cover stories influences the features produced in association with a given concept (Borghi & Barsalou, 2019). Half of the presented Scenarios described a Public, and thus potentially perceived as Dangerous, situation (e.g., supermarket), while the other half described a Private and, thus perceived as safer, context (e.g. different rooms of one's own home). Based on the hypothesis that Public Scenarios should be perceived as more Dangerous than Neutral settings, we predicted that they would also produce overall more careful, and hence slower, responses (Hypothesis 2a).

This manipulation allowed testing whether responses to affordances differ when the interaction with a given object is presented in contexts involving a high vs. low degree of contagion risk. Specifically, we hypothesized that Public Scenarios would elicit the longest response times in response to objects whose affordances are perceived as more Dangerous compared to Neutral ones (Hypothesis 2b). Since it was not possible to collect data in a no-COVID-19 situation, we reasoned that manipulating the Public vs. Private character of the Scenarios in the present situation would allow us to identify whether COVID-19 affected the perception of objects' affordances in potentially risky situations, while this was not the case for less risky and safer situations.

Third, we aimed to evaluate whether responses to object affordances differed when they were embedded in sentences using the second person linguistic pronoun compared to the third one, as the former is likely more engaging than the latter.

We hypothesized longer RTs (i.e., a proxy of the highest perception of danger) in response to Dangerous objects preceded by cover stories referring to a Public Scenario when embedded in target sentences using the second person linguistic pronoun compared to the third person one. In addition, we predicted to observe longer RTs in response to Dangerous than Neutral objects when they are both embedded in second-person sentences (Hypothesis 3).

As mentioned, Experiments 1 and 2 tested the same hypotheses on two separate samples of Italian and German participants. This was primarily designed to replicate the same procedure in two different samples, and we expected to report the same effects for the two Experiments for all

planned contrasts. Possible differences - potentially connected to the different degree of containment measures and perceived risk in the two countries - were investigated only at an exploratory level (not pre-registered).

Overall, we believe that this study can have both scientific and practical important implications.

Scientific implications involve the available knowledge on the flexibility of affordances and their context-dependency. We contribute to the understanding of whether the current external situation (pandemic and fear of infection) influences motor responses to object affordances, particularly in those social contexts where the virus is known to spread more easily. While providing evidence on the notion of dangerous affordances, our study informs about the degree of their flexibility (e.g., depending on the context in which they are activated, or the agent implied by linguistic pronouns) and their influence on motor behaviour. These results extend our knowledge on the context-dependency of affordance activation, with important implications for future studies addressing the issue of their automatic vs. flexible activation.

The implications of our results, however, go beyond basic research on motor behaviour and affordances. The evidence we provide has the potential to show whether people have already incorporated the tendency to be cautious while interacting with certain objects and contexts, and to what extent linguistic messages can shape this tendency. This supports the notion that the motor responses typically activated by everyday objects are not fully automatic but depend on the context in which they are presented, i.e., as shown by slower responses to sentences describing actions involving those objects. We thus provide a behavioural task to measure at both individual and group level the attitude towards everyday objects/contexts, giving us an indirect measure of their perceived dangerousness. This might be useful for the general population, as well as in more fragile participants, such as COVID-19 patients after recovery. This type of measure might be used to study the reactions of the general population, or specific subgroups, to potentially dangerous interactions with everyday objects. This might both contribute to better targeting of the communications regarding the spread of the virus (prevention) or more accurate monitoring of more fragile subgroups once the lockdowns are eased and more possibilities of social interactions arise.

Materials & Methods

Pre-registration

The study was pre-registered on the Open Science Framework (OSF, https://osf.io/7bh8s). All the information given in this paper, as well as all the materials and data, are shared on the project page on OSF (https://osf.io/PZGFX/).

Participants

Participants were native Italian (Experiment 1) and German (Experiment 2) speakers aged 18-40. Both left and right-handed participants were included.

We defined this age range to maximize our chance to meet the requirements of the sampling plan, particularly given the online testing which is likely to attract a much larger number of young adults. This is also in line to maximize comparability with the existing evidence on affordances and takes into account a larger variability in reaction times (as well as in reading speed) with increased age. We are, however, aware that data collected with older adults, particularly from those subgroups that appear to be more fragile and at risk for the disease, might have a very important theoretical and practical relevance. For this reason, in addition to the two pre-registered samples, we recruited participants aged over 40 as an additional exploratory sample.

Participants were recruited among students at the University of Pavia and Rome (Experiment 1) and the University of Potsdam (Experiment 2), as well as from the general population (Italy, Germany). Participation was voluntary and there was no individual monetary compensation. At the end of the study, one of the participants was drawn to receive a voucher. Rather than participating in this lottery, psychology students from the Universities of Pavia and Potsdam had the possibility to collect participant-hours for their enrolment in the online study, as prescribed by their Faculties.

Recruitment, data collection, and data storage will be performed according to the current regulations and the protocol will be approved by the Ethics committee of the University of Pavia before the beginning of data collection.

Sampling Plan

The sampling was based on a Bayesian Sequential design with maximal N (Schönbrodt & Wagenmakers, 2018).

In this design, data collection continued until (1) a certain level of evidence (Bayes Factor) was obtained or (2) a maximal number of participants was reached. We opted for this design as an efficient alternative to open-ended sequential designs and fixed-N designs, given the constraints of online testing and the critical time window for testing this time-sensitive task.

The threshold for evidence was set at Bayes Factor >10, while the smallest effect size of interest (SESOI) was set to d = 0.3. The SESOI was defined based on both theoretical and practical reasons. We reasoned that any effect smaller than the SESOI would be negligible, as it would likely have little to no impact on participant's behaviour in everyday life (i.e. it would not be useful as prevention or monitoring tool as discussed in the introduction). Furthermore, this choice is in line with the use of sequential analyses to take into account the possible resource limitations of online testing.

To determine the maximal N, we performed a Bayes Factor Design Analysis with Fixed N (https://tellmi.psy.lmu.de/felix/BFDA_app). First, we obtained a profile of Distribution of Default Bayes Factors with the following parameters:

- Bayes Factor > 10
- Effect size d = 0.3
- Sample size: 200

- Decision Boundaries
- • Lower Boundary: 0.1
- • Upper Boundary: 10
- Prior on Effect Size:
- • Default Prior: Cauchy (μ = 0, r = p2/2)

Then, based on these results we calculated that with an effect size of 0.3 and the default prior, we would need at least 220 observations to obtain a Bayes factor larger than 10 with a probability of p = 0.6.

220 participants were thus chosen as maximal N for each experiment.

While BF monitoring is in principle allowed at every participant, for reasons of feasibility we monitored BFs every 40 participants – This was also compatible with the possible presence of outliers and noisy data in online data collection, which might reduce the actual sample.

Since we had several planned directional tests, only BFs of two contrasts were monitored: namely, the ones connected to Hypothesis 1 and 2a. BFs with default priors were calculated to quantify the observed evidence in terms of odds ratio between the null and the alternative hypothesis for each test separately (see below for details). Data collection was stopped once both BFs will be above the expected threshold (>10) or once the maximal N will be reached, whichever comes first.

The two Experiments were monitored separately. Data collection was performed online, so no blinding was required. Data analysis was blind to the conditions of the experiment – two separate operators thus performed sequential BFs monitoring and data analysis.

Stimuli

For both Experiments 1 and 2, critical stimuli consisted of ninety-six sentences obtained by the combination of a personal pronoun (second person vs. third person), a hand-related action verb, and an appropriate target object (e.g., "You grasp the cup"). Target objects were divided into two categories: potentially Dangerous objects and Neutral ones, both including everyday items (e.g., "handle" vs. "toothbrush"; see Table 1 for the full list of stimuli). Additionally, we included twenty-four filler items replicating the same sentence structure as the critical ones, but describing impossible actions (e.g., "You chop the fork").

In total, we presented 120 stimuli for each experiment, presented in Italian for Experiment 1 and German for Experiment 2.

To manipulate the context in which object affordances are activated, we created a total of twenty brief cover stories divided into ten Private (e.g., "You are at home sitting on your couch and reading a book.") and ten Public (e.g., "You are in line at the post office and waiting for your turn.") Scenarios.

All sentences and cover stories were presented in written form (see Table 2 for a full list).

Please note that we chose to use written sentences over pictures or auditory stimuli to maximize control over stimuli presentation in the online study. Nevertheless, this choice is based on consistent literature showing how object

Table 1a. Cover stories to be used in the Public and in the Private Scenarios (Italian and German)

Scenario	Type
Italian	
Sei all'ufficio postale e stai aspettando il tuo turno.	Public
Sei fuori dal supermercato e stai aspettando che apra.	Public
Sei dentro una libreria e stai pagando il conto.	Public
Sei in strada e stai camminando sul marciapiede.	Public
Sei davanti a una banca e stai entrando a prelevare.	Public
Sei in edicola e stai acquistando un quotidiano.	Public
Sei in un ambulatorio e ti stai sedendo in sala d'attesa.	Public
Sei in metropolitana e stai scendendo dal treno.	Public
Sei nell'atrio del tuo condominio e stai aspettando l'ascensore.	Public
Sei davanti a una gelateria e stai aspettando un gelato.	Public
Sei sul divano di casa e stai leggendo un libro.	Private
Sei in camera da letto e stai ascoltando musica classica.	Private
Sei in cucina e stai preparando una tisana.	Private
Sei in bagno e ti stai lavando i denti.	Private
Sei in giardino e stai innaffiando le piante.	Private
Sei nello studio e stai scrivendo una lettera.	Private
Sei in sala da pranzo e stai facendo colazione.	Private
Sei in balcone e stai prendendo il sole.	Private
Sei in poltrona e stai guardando la televisione.	Private
Sei in camera e stai piegando il bucato.	Private
German	
Du bist bei der Post und wartest bis Du drankommst.	Public
Du bist vorm Supermarkt und wartest bis er eröffnet.	Public
Du bist in einem Buchladen und bezahlst.	Public
Du gehst eine Straße entlang.	Public
Du bist in einer Bank, um Geld abzuheben.	Public
Du bist am Kiosk und kaufst eine Zeitung.	Public
Du bist in einer Arztpraxis und wartest im Wartezimmer.	Public
Du bist in der U-Bahn und steigst aus dem Zug aus.	Public
Du bist im Flur vom Deinem Haus und wartest auf den Fahrstuhl.	Public
Du bist vor einer Eisdiele und wartest auf Dein Eis.	Public
Du bist auf Deinem Sofa und liest ein Buch.	Private
Du bist im Schlafzimmer und hörst klassische Musik.	Private
Du bist in der Küche und machst einen Kräutertee.	Private
Du bist im Bad und putzt Dir die Zähne.	Private
Du bist im Garten und gießt die Pflanzen.	Private
Du bist im Arbeitszimmer und schreibst einen Brief.	Private
Du bist im Wohnzimmer und frühstückst.	Private

Scenario	Type
Du bist auf dem Balkon und sonnst Dich.	Private
Du bist im Sessel und schaust fern.	Private
Du bist im Schlafzimmer und faltest die Wäsche.	Private

Table 1b. English translation of the Cover stories presented in Table 1a

Scenario
English Translation
You are at the post office and waiting for your turn.
You are outside the supermarket and waiting for it to open.
You are inside a bookstore and you are paying the bill.
You are on the street and walking on the sidewalk.
You are in front of a bank and you are entering to withdraw cash.
You are at a newsstand and you are buying a newspaper.
You are at an outpatient clinic and you are sitting in the waiting room.
You are on the subway and you are getting off the train.
You are in the lobby of your building and you are waiting for the elevator.
You are in front of an ice cream parlor and you are waiting for the ice-cream.
You are on your couch and reading a book.
You are in the bedroom and listening to classic music.
You are in the kitchen and preparing an herbal tea.
You are in the bathroom and brushing your teeth.
You are in the garden and watering the plants.
You are in the study and writing a letter.
You are in the living room and having breakfast.
You are on the balcony and sunbathing.
You are in an armchair and watching the television.
You are in the bedroom and folding the laundry.

affordances can be activated by sentences embedding their nouns and actions performed onto them (see above).

Procedure

After giving their informed consent to the procedure, participants were presented with the main task and two additional questionnaires. The procedure was administered fully online (PC or laptop with keyboard required, no smartphone or tablet allowed) through PsychoPy v3 (Peirce et al., 2019) via the Pavlovia repository with all responses (accuracy and response times, RTs) being recorded and anonymously stored for offline analyses. Questionnaires were created using the software package SoSci Survey (Leiner, 2018) and administered by linking it directly at the end of the main task.

The protocols to run both Experiments can be found in our project's OSF repository (see above).

In the main task, we presented a total of 120 stimuli randomly divided into 20 blocks. Each short block started with a cover story. Participants were instructed to carefully read the cover story to answer questions that might randomly appear on the screen at the end of the block.

Then, a sequence of six sentences followed (see Figure 1). Each critical stimulus was presented twice (once following a Public, once following a Private Scenario), randomly assigned to one of the Scenarios. In this sense, there was no pre-assigned match between sentences and scenarios, and the content of the cover story was task-irrelevant as to the main task.

Following the presentation of a fixation cross (200 ms), each sentence was presented at the center of the computer screen until the participant's response, or for a maximum of three seconds in the case of a missed response (see Figure 2). Participants were requested to carefully read the cover story (scenario) and then to evaluate, via the "q" and "p" keys of their keyboard, whether the action described by the sentence was possible or impossible. Half of the participants responded with "q" = possible and "p" =impossible, while the other half responded with reversed keys. Participants were requested to respond as accurately and as fast as possible. They were allowed to familiarize themselves with the task during a short practice session (two additional combinations of cover stories and twelve sentences) preceding the experiment. During both practice and experiment, a "too slow" feedback was presented whenever participants exceeded the response time limit of three seconds. During the practice trials, additional feedback was given to "Correct" and "Incorrect" responses, allowing naïve participants to familiarize themselves with the task. Participants were informed that they would receive feedback only for practice trials.

After each block (one cover story + six trials), participants were presented with three simple arithmetic tasks (e.g., "23+5") and asked to choose the correct result out of two alternatives (e.g. "28 or 23"). This non-linguistic task served as a positive control to check for the participant's responsiveness and compliance with the instructions.

In four of the blocks (20%), a question on the cover story (scenario) preceded the arithmetic task. The questions were such as "Did the cover story involve a newspaper?" and participants responded Yes or No with a keypress.

Following the main task, participants were requested to fill out two additional questionnaires: the standard Edinburgh 10-items handedness inventory (Oldfield, 1971) and the Generalized Anxiety Disorder 7-item (GAD-7) scale (Spitzer et al., 2006).

In addition, we collected their response to four additional questions, namely on their age, mother tongue (inclusion criteria), gender, and location. Additional questions pertained to their living situation (e.g., whether they lived alone, and if not whether they shared their household with people at risk of COVID-19 infection) as well as checked for possible COVID-19 infection (e.g., whether they tested positive to the virus). Finally, we asked participants to state, to the best of their knowledge, the main mechanisms of the potential spread of COVID-19. Responses to the COVID-19 related questions were used exploratory analyses.

Table 2a. List of all critical stimuli divided by Object Type

Neutral			Dangerous		
Italian	**German**	**English Translation**	**Italian**	**German**	**English Translation**
Tu afferri il cucchiaio	Du greifst der Löffel.	You grab the spoon.	Tu afferri la maniglia	Du greifst die Türklinke.	You grasp the handle
Tu sollevi il libro	Du hebst das Buch.	You lift the book	Tu premi il pulsante	Du drückst den Knopf.	You push the button
Tu chiudi il barattolo	Du schließt das Einmachglas.	You close the jar	Tu spingi il carrello	Du schiebst den Einkaufswagen.	You push the cart
Tu prendi lo spazzolino	Du nimmst die Zahnbürste.	You take the toothbrush	Tu afferri i soldi	Du nimmst das Geld.	You grab the money
Tu sollevi la tazzina	Du hebst die Kaffeetasse.	You lift the cup	Tu riempi la borsa	Du füllst die Tasche.	You fill the bag
Tu sposti la forchetta	Du bewegst die Gabel.	You move the fork	Tu leggi il giornale	Du liest die Zeitung.	You read the newspaper
Tu afferri il tovagliolo	Du nimmst die Serviette.	You grasp the napkin	Tu chiudi il portone	Du schließt die Tür.	You close the door
Tu afferri la spazzola	Du greifst die Bürste.	You grab the brush	Tu prendi il biglietto	Du holst das Ticket.	You get the ticket
Tu pulisci la tazza	Du putzt die Tasse.	You clean the cup	Tu prendi la ricevuta	Du nimmst den Kassenbon.	You take the receipt
Tu pieghi il panno	Du faltest das Tuch.	You fold the cloth	Tu stringi le monete	Du greifst die Münzen.	You grab the coins
Tu stringi il tappo	Du verschließt die Flasche.	You tighten the bottle cap	Tu sposti la valigia	Du bewegst den Koffer.	You move the suitcase
Tu chiudi la pentola	Du schließt den Kochtopf.	You close the pot	Tu apri il sacchetto	Du öffnest den Beutel.	You open the bag
Lei afferra il cucchiaio	Sie greift der Löffel.	She grabs the spoon.	Lei afferra la maniglia	Sie greift die Türklinke.	She grasps the handle
Lei solleva il libro	Sie hebt das Buch.	She lifts the book	Lei preme il pulsante	Sie drückt den Knopf.	She pushes the button
Lei chiude il barattolo	Sie schließt das Einmachglas.	She closes the jar	Lei spinge il carrello	Sie schiebt den Einkaufswagenagen.	She pushes the cart
Lei prende lo spazzolino	Sie nimmt die Zahnbürste.	She takes the toothbrush	Lei afferra i soldi	Sie nimmt das Geld.	She grabs the money
Lei solleva la tazzina	Sie hebt die Kaffeetasse.	She lifts the cup	Lei riempie la borsa	Sie füllt die Tasche.	She fills the bag
Lei sposta la forchetta	Sie bewegt die Gabel.	She moves the fork	Lei legge il giornale	Sie liest die Zeitung.	She reads the newspaper
Lei afferra il tovagliolo	Sie nimmt die Serviette.	She grasps the napkin	Lei chiude il portone	Sie schließt die Tür.	She closes the door
Lei afferra la spazzola	Sie greift die Bürste.	She grabs the brush	Lei prende il biglietto	Sie holt das Ticket.	She gets the ticket
Lei pulisce la tazza	Sie putzt die Tasse.	She cleans the cup	Lei prende la ricevuta	Sie nimmt den Kassenbon.	She takes the receipt
Lei piega il panno	Sie faltet das Tuch.	She folds the cloth	Lei stringe le monete	Sie greift die Münzen.	She grabs the coins
Lei stringe il tappo	Sie verschließt die Flasche.	She tightens the bottle cap	Lei sposta la valigia	Sie bewegt den Koffer.	She moves the suitcase
Lei chiude la pentola	Sie schließt den Kochtopf.	She closes the pot	Lei apre il sacchetto	Sie öffnet den Beutel.	She opens the bag

Table 2b. List of filler items

Italian	German	English Translation
Tu cuci l'asfalto	Du nähst den Asphalt.	You sew the asphalt.
Tu cucini il portone	Du kochst die Tür.	You cook the door.
Tu ferisci il bottone	Du schmerzt die Taste.	You hurt the button.
Tu mescoli il binario	Du mischst das Gleis.	You mix the platform.
Tu impasti la maniglia	Du zerknetest die Klinke.	You knead the handle.
Tu rammendi la casa	Du flickst das Haus.	You mend the house.
Tu stiri la casa	Du bügelst das Haus.	You iron the house.
Tu bevi la forchetta	Du trinkst die Gabel.	You drink the fork.
Tu triti la forchetta	Du hackst die Gabel.	You chop the fork
Tu affetti il vaso	Du schneidest die Vase.	You slice the vase
Tu cuci il cucchiaio	Du nähst den Löffel.	You sew the spoon.
Tu ingoi il cuscino	Du schluckst das Kissen.	You swallow the pillow.
Lei stira la casa	Sie bügelt das Haus.	She irons the house.
Lei beve la forchetta	Sie trinkt die Gabel.	She drinks the fork.
Lei trita la forchetta	Sie hackt die Gabel.	She chops the fork.
Lei affetta il vaso	Sie schneidet die Vase.	She cuts the vase.
Lei cuce il cucchiaio	Sie näht den Löffel.	She sews the spoon.
Lei ingoia il cuscino	Sie schluckt das Kissen.	She swallows the pillow.
Lei cuce l'asfalto	Sie näht den Asphalt.	She sews the alphalt.
Lei cucina il portone	Sie kocht die Tür.	She cooks the door.
Lei ferisce il bottone	Sie schmerzt die Taste.	She hurts the button.
Lei mescola il binario	Sie mischt das Gleis.	She mixes the platform.
Lei impasta la maniglia	Sie zerknetet die Klinke.	She kneads the handle.
Lei rammenda la casa	Sie flickt das Haus.	She mends the house.

Handedness and GAD-7 scores, as well as gender and location, were not included in the main, pre-registered analyses, but they served only the purpose of exploratory analyses. In particular, the GAD-7 score was used to measure the level of anxiety a participant experienced in the two weeks before the experiment. A higher score in this test might be an indicator of anxiety related to the pandemic and might be a moderator of the magnitude of the measured behavioural effects.

Analyses

Participants not completing the experiment or not fitting into the inclusion criteria (age and mother tongue) were excluded from further analyses. First, accuracy rates for the arithmetic task were calculated. Participants with an accuracy lower than 90% were excluded from further analysis.

For all included participants, we analyzed only responses to the critical stimuli, discarding the filler items.

For each participant, we first calculated the mean response accuracy as the percentage of correct responses over the total critical items. Participants with response accuracy lower than 90% were excluded from subsequent analyses (accuracy outliers), and for the remaining participants, only correct responses were analyzed.

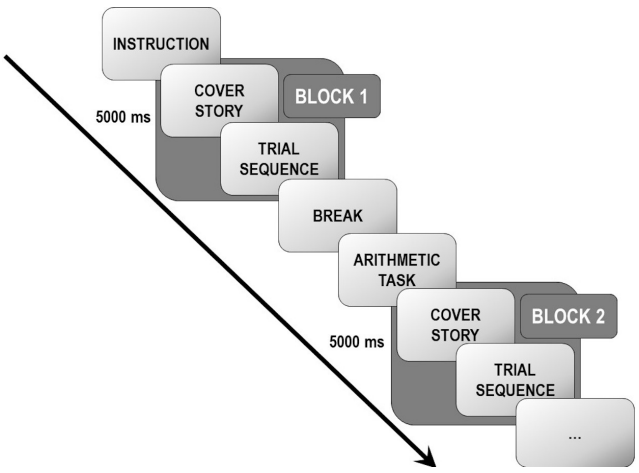

Figure 1. Schematic representation of the experimental procedure (blocks).

The remaining data were trimmed according to the following criteria, aimed at removing outliers (RTs outliers) in the following sequence:

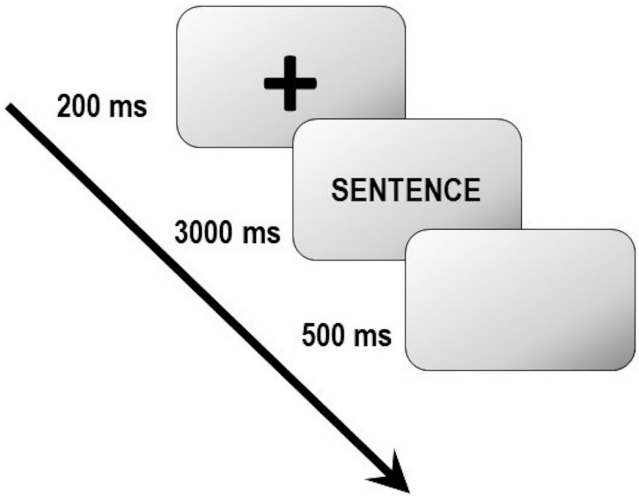

Figure 2. Schematic representation of the trial sequence.

- all trials with RTs < 200 ms, as they signal unusually short reaction times or unintentional button presses;
- all trials with RTs > 3000 ms (RTs over the response time limit) or no response;

Then, we removed any remaining trial with RTs exceeding 3 standard deviations below or above each participant's individual mean RTs (all conditions collapsed).

This procedure ensured to eliminate outliers in terms of very short (likely accidental or anticipated responses) or unusually long RTs, likely due to a lack of attention while preserving genuinely long responses due to the experimental manipulation (Ratcliff, 1993). With these data trimming procedures, we aimed to exclude a maximum of 10% of the trials. After data trimming, only participants with at least 90% of the trials were retained for further analyses: this ensured that a large number of trials were retained for subsequent analyses.

Statistical analyses were performed employing paired sample, one-tailed (measure 1 > measure 2) Bayesian t-tests for the following contrasts of interest:

Hypothesis 1: Dangerous vs Neutral objects (all RTs collapsed across participants by Object Type).

Hypothesis 2a: Public vs Private Scenario (all RTs collapsed across participants by Scenario).

Hypothesis 2b: One contrast for Dangerous objects in the Public vs. Private Scenario, and one contrasting in Public vs. Private Scenario the difference between Dangerous and Neutral objects (Neutral objects RTs subtracted from the Dangerous ones).

(two tests for each Experiment).

Hypothesis 3: One contrast for Dangerous Objects embedded in Second-person sentences vs. third-person sentences in the Public, and one for Dangerous vs. Neutral objects embedded in second-person sentences in the Public (two tests for each Experiment).

Bayes Factors with default priors were calculated to quantify the observed evidence in terms of odds ratio between the null (H_0) and the alternative hypothesis (H_1) evaluated against a threshold of BF ⩾10 (below = anecdotal evidence, above = moderate to strong (if >30) evidence. We conventionally indicated the evidence in favour of the alternative hypothesis BF_{10} and the evidence in favour of the null hypothesis BF_{01}.

Data filtering and analysis were identical across Experiments 1 and 2, and the two experiments were analyzed separately. All statistical analyses were performed with the Bayesian statistics module of the software JASP (V.0.12.2, JASP Team, 2020).

Predictions

We outline below our main predictions, indicating the Hypothesis to which they refer (see Table 3, Design Planner). For Hypothesis 1-3, we expected to observe the same effects in Experiment 1 and 2, as we made no specific hypotheses as to differences between the two samples. Statistical comparisons between the two experiments, or their subgroups, were performed only as exploratory analyses and they thus were not part of the registered analyses/hypotheses.

Effect of Object Type (Hypothesis 1)

Based on the available evidence on dangerous affordances, we predicted slower RTs (suggestive of stronger perception of threats) in response to potentially Dangerous objects as compared to the Neutral ones. We thus expected to report moderate to strong evidence in this sense (BF_{10} ⩾10).

If the evidence was only anecdotal (BF_{10}<10), this would suggest that the stimuli we selected were likely not activating object affordances, particularly in terms of neutral vs. dangerous affordances, to such a degree to affect response times.

In case of moderate to strong evidence of no difference between the two types of objects (BF_{01} ⩾10), we concluded that the two Object Types did not differ – at least behaviourally – concerning their perceived dangerousness.

Effect of Scenario (Hypothesis 2a)

In keeping with our hypothesis of perceived dangerousness of Public settings we predicted that they would produce more careful, and hence slower, responses compared to neutral ones (e.g., home). We expected to observe moderate to strong evidence (BF_{10}⩾10) in favour of a difference between the two types of scenarios, with slower RTs for sentences following the Public compared to the Private one.

If the evidence was only anecdotal (BF_{10}<10), we concluded that our Scenarios were not salient enough to activate a specific Public/Private context for affordance activation, so that a behavioural difference in their perceived dangerousness (if any) is likely negligible.

If there was moderate to strong evidence of no difference between the two types of Scenario (BF01⩾10), we concluded that the two Scenarios were not perceived at different degrees of dangerousness as they did not elicit detectable behavioural differences.

Table 3. Design Planner

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given different outcomes
Are objects that in normal conditions evoke affordances, and facilitate our motor actions, now perceived as more dangerous (thus possibly interfering with previous motor planning) compared to neutral objects whose status has not changed?	Processing nouns referring to objects that are now perceived as more Dangerous will elicit longer RTs than the Neutral ones. (Hypothesis 1)	The sampling is based on a Bayesian Sequential design with maximal N (Schönbrodt & Wagenmakers, 2018). In this design, data collection will continue until (1) a certain level of evidence (Bayes Factor) is obtained or (2) a maximal number of participants will be reached. We opted for this design as an alternative to open-ended sequential designs and fixed-N designs, given the constraints of online testing and resource availability. The threshold for evidence was set at Bayes Factor >10, while the smallest effect size of interest was set to d = 0.3. To determine the maximal N, we performed a Bayes Factor Design Analysis with Fixed N (https://tellmi.psy.lmu.de/felix/BFDA_app) First, we obtained a profile of Distribution of Default Bayes Factors. with the following parameters: - Bayes Factor > 10 - Effect size d = 0.3 - Sample size: 200 - Decision Boundaries: - • Lower Boundary: 0.1 - • Upper Boundary: 10 - Prior on Effect Size: - • Default Prior: Cauchy (μ = 0, r = p2/2) Then, based on these results we calculated that with an effect size of 0.3 and the default prior, we would need at least 220 observations to obtain a Bayes factor larger than 10 with a probability of p = 0.6. 220 participants were thus chosen as maximal N for each experiment. While BF monitoring is in principle allowed every each participant, for reasons of feasibility we will monitor BFs every 40 participants – this is also compatible with the possible presence of outliers and noisy data in online data collection, which might reduce the actual sample. Since we have several planned directional tests, only BFs of two contrasts will be monitored: namely, the ones connected to Hypothesis 1 and 2a. BFs with default priors will be calculated in order to quantify the observed evidence in terms of odds ratio between the null and the alternative hypothesis for each test	Paired sample, one tailed (measure 1 > measure 2) Bayesian t-test contrasting RTs to Dangerous vs. Neutral Objects (all RTs collapsed across participants by Object Type, one test for each Experiment). Bayes Factors will be calculated and evaluated against a threshold of BF ≥10 (below = anecdotal evidence, above = moderate to strong (if >30) evidence.	1) BF ≥10 with longer RTs in response to Dangerous compared to Neutral Objects → Hp 1 confirmed, suggesting a stronger perception of threats (slower responses) linked to certain types of objects and not to others. 2) BF_{10}<10 → Only anecdotal evidence for Hp1, suggesting that the stimuli we selected were likely not activating object affordances at such a degree to significantly affect response times, the evidence is inconclusive. 3) BF_{01}≥10 with no difference between RTs for the two Object Types → the two Object Types do not differ – at least behaviourally – concerning their perceived dangerousness. 4) BF_{01}<10 with no difference between RTs for the two Object Types → There is only anecdotal evidence of no difference between the Object Types, the evidence is inconclusive.

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given different outcomes
		separately (see below for details). Data collection will be stopped once both BFs will be above the expected threshold (>10) or once the maximal N will be reached, whichever comes first. The two Experiments will be monitored separately.		
Are Public Scenarios now perceived as more dangerous than the Private ones?	A perceived increased dangerousness will produce longer RTs following the presentation of a Public compared to a Private Scenario (Hypothesis 2a)	Same sampling as Hp1	Paired sample, one tailed (measure 1 > measure 2) Bayesian t-test contrasting RTs to Public vs. Private Scenarios (all RTs collapsed across participants by Scenario, one test for each Experiment). Bayes Factors will be calculated and evaluated against a threshold of BF ≥10 (below = anecdotal evidence, above = moderate to strong (if >30) evidence.	1) BF ≥10 with longer RTs in response to Public compared to Private scenarios → Hp2a confirmed, that is increased perceived dangerousness of Public settings produces longer RTs compared to the Private ones. 2) BF_{10}<10 → Only anecdotal evidence for Hp2a suggesting that our Scenarios are not salient enough in order to activate a specific Public/Private context for affordance activation, and while there might be a behavioural difference in their perceived dangerousness, it is likely negligible. 3) BF_{01}≥10 with no difference between RTs for the two Scenario → There is concrete evidence for no difference between the two Scenario, that are thus likely perceived as similar and they do not produce detectable behavioural differences. 4) BF_{01}<10 with no difference between RTs for the two Scenarios → There is only anecdotal evidence of no difference between the two Scenarios, the evidence is inconclusive.
Do responses to affordances differ when the same object is represented in contexts involving a high vs. low	We hypothesize that object affordances are differently activated for object nouns according to the Scenario in which	Same sampling as Hp1	Two paired sample, one tailed (measure 1 > measure 2) Bayesian t-test contrasting (1) RTs to Dangerous objects in Public Scenario vs. Dangerous Object in the Private one,	1) BF ≥10 with longer RTs in response to Dangerous objects in the Public Scenario compared to the Private one AND

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given different outcomes
degree of contagion risk? If so, is the effect specific only to certain object types, e.g. the most dangerous ones?	they are embedded. We thus expect to report evidence in favour of slower RTs in response to Dangerous objects in the Public Scenario compared to the Private one. Similarly, we expect to report evidence in favour of a difference in RTs between Dangerous and Neutral object in the Public Scenario, with slower RTs for the former. This would confirm the specificity of this effect for Dangerous objects. (Hypothesis 2b)		and (2) the difference between Dangerous and Neutral objects in the Public scenario vs. the Private one (two tests for each Experiment). Bayes Factors will be calculated and evaluated against a threshold of BF ≥10 (below = anecdotal evidence, above = moderate to strong (if >30) evidence.	BF ≥10 with larger difference between RTs for Dangerous objects and Neutral ones in the Public Scenario vs. the Private one → Hp2b confirmed 2) BF_{10}<10 → If only anecdotal evidence for either or both tests, we will conclude that the increased perceived dangerousness – if any – of certain object types in terms of dangerous affordances is not strong enough to modulate behavioural responses. 3) BF_{01}≥10 → If moderate to strong evidence of no difference in the two comparisons, we will conclude that there is no evidence of increase perceived dangerousness selective only for specific Object Types or the Scenarios in which they are embedded. 4) BF_{01}<10 → Only anecdotal evidence in both tests of no difference between perceived dangerousness of specific object types, the evidence is inconclusive.
Are object affordances differently activated when they are embedded in sentences using the second person linguistic pronoun vs. the third person one?	We hypothesize longer RTs (i.e. a proxy of the highest perception of danger) for Dangerous objects, preceded by cover stories referring to a Public scenario and embedded in target sentences using a second person linguistic pronoun vs. third person pronoun. In addition, we hypothesize that longer RTs in response to	Same sampling as Hp1	Two paired sample, one tailed (measure 1 > measure 2) Bayesian t-test contrasting (1) RTs to Dangerous Object embedded in Second-person sentences vs. third person sentences in the Public Scenario and (2) responses to Dangerous vs. Neutral objects embedded in second-person sentences in the Public scenario (two tests for each Experiment). Bayes Factors will be calculated and evaluated against a threshold of BF ≥10 (below = anecdotal evidence, above = moderate to strong (if >30)	1) BF ≥10 with evidence in favour of a difference between Dangerous objects embedded in second-person sentences vs. third-person sentences within the Public Scenario, with slower RTs for the former. AND Moderate to strong evidence in favour of a difference between Dangerous (slower) vs. Neutral objects embedded in second-person sentences within the Public scenario.

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given different outcomes
	Dangerous objects will be measured vs. Neutral objects when they are both embedded in second-person sentences. (Hypothesis 3)		evidence.	→ Hp3 confirmed 2) $BF_{10} < 10$ → If both of the above contrasts will show only anecdotal evidence, we will report no conclusive evidence in favour of a combined effect of Scenario, Object Type and Perspective, with final interpretation depending on the presence or not of evidence in favour of effects of Scenario and Object Type (see above). If there will be only enough evidence in favour of the first contrast, we will conclude that the use of second-person sentences impacts the activation of object affordances, but this is true regardless of Object Type. 3) $BF_{01} \geq 10$ → Moderate to strong evidence in favour of no difference in both contrasts, we will conclude that the effects due to the increased perceived dangerousness of everyday objects – if any (see contrasts above) is independent from the perspective implied by the sentences in which they are embedded. 4) $BF_{01} < 10$ → Only anecdotal evidence of no difference in the two contrasts, no conclusive evidence.

Combined effects of Scenario and Object Type (Hypothesis 2b)

We hypothesized that object affordances were differently activated for Dangerous and Neutral objects according to the Scenario in which they were embedded.

We thus expected to report moderate to strong evidence (BF_{10} ⩾10) in favour of slower RTs in response to Dangerous objects in the Public Scenario compared to the Private one.

Similarly, we expected to report moderate to strong evidence (BF_{10} ⩾10) in favour of a larger difference between Dangerous and Neutral objects in the Public Scenarios compared to the Private one.

If the evidence was only anecdotal (BF_{10}<10) for either or both tests, we concluded that the perceived dangerousness – if any – of certain Object Types in terms of dangerous affordances was not strong enough to modulate behavioural responses.

If there was moderate to strong evidence (BF_{01}⩾10) of no difference in the two comparisons, we concluded that there is no evidence of perceived dangerousness selective for specific Object Types or the Scenarios in which they were embedded.

Combined effect of Scenario, Perspective and Object Type (Hypothesis 3)

We hypothesized that the three factors manipulated in this study might play a joint role in shaping a pervasive effect on our interactions with/perception of everyday objects.

To this aim, we predicted moderate to strong evidence (BF_{10} ⩾10) in favour of slower responses to Dangerous objects embedded in second- than third-person sentences within the Public Scenario.

To support the specificity of this effect for Dangerous objects, we also predicted to report moderate to strong evidence (BF_{10} ⩾10) in favour of slower responses to Dangerous vs. Neutral objects when embedded in second-person sentences within the Public Scenario.

If both of the above contrasts showed only anecdotal evidence, we reported no conclusive evidence in favour of a combined effect of Scenario, Object Type and Perspective, with the final interpretation depending on the presence or lack of evidence in favour of the effects of Scenario and Object Type described above.

If there was only enough evidence in favour of the first contrast, we concluded that the use of second-person sentences impacted the activation of object affordances, but this was true regardless of Object Type.

If there was moderate to strong evidence (BF_{01}⩾10) in favour of no difference in both contrasts, we will conclude that the effects due to the perceived dangerousness of everyday objects – if any (see contrasts above) – were independent of the Perspective implied by the sentences in which they were embedded.

Results

Data collection for both Experiments took place between July and October 2020.

Experiment 1 – Italian

A total of 235 participants were initially recruited in the experiment. One participant had a native language other than Italian and was excluded. Participants having accuracy rates < 90% in the arithmetic (positive control) task were excluded from further analyses (N = 64). Participants having accuracy rates < 90% in critical trials (main task) were excluded from further analyses (N = 26). Three participants having less than 90% of data after we removed errors and outlier reaction times (see below) were also excluded. A total of 141 participants were included in the final analyses (96 female, 39 male; Mean age = 25, SD = 4; see Supplementary Materials for further descriptive statistics).

Effect of Object Type (Hypothesis 1)

As to the comparison between the two Object Types, the directional bayesian t-test did not show evidence in favour of our hypothesis of slower RTs for dangerous objects compared to neutral ones (BF_{10} = 0.04, BF_{01}=261). When considering average RTs (see Figure 3), responses to dangerous objects (0.957 s) were indeed faster than to neutral ones (1.039 s). When considering a bayesian t-test in the opposite direction, in fact, very strong evidence was observed in favour of the alternative hypothesis (BF_{10}= 5.667e+22).

Effect of Scenario (Hypothesis 2a)

When considering the comparison between the two scenarios, we did not report any evidence in favour of slower RTs for sentences following the Public compared to the Private one (BF_{10}=0.635, BF_{01}=1.576). In fact, the mean RTs were 1.002 and 0.994 s, respectively.

Combined effects of Scenario and Object Type (Hypothesis 2b)

When comparing RTs in response to Dangerous objects within the Public Scenario compared to the Private one, we reported strong evidence in favour of the null hypothesis (BF_{10}=0.034, BF_{01}=29.7). In fact, on average the former were only a few milliseconds faster (0.951 s) than the latter (0.964 s).

Similarly, when considering the difference between Dangerous and Neutral objects in the Public Scenarios, we reported very strong evidence (BF_{10}=0.005, BF_{01}=213) supporting H_0. Dangerous objects embedded in Public scenarios yielded faster responses than the Neutral ones (0.951 and 1054 s, respectively), in line with the results for Hypothesis 1. Indeed, when exploring a t-test in the opposite direction we reported very strong evidence in favour of H_1(BF_{10}=1.05e+18).

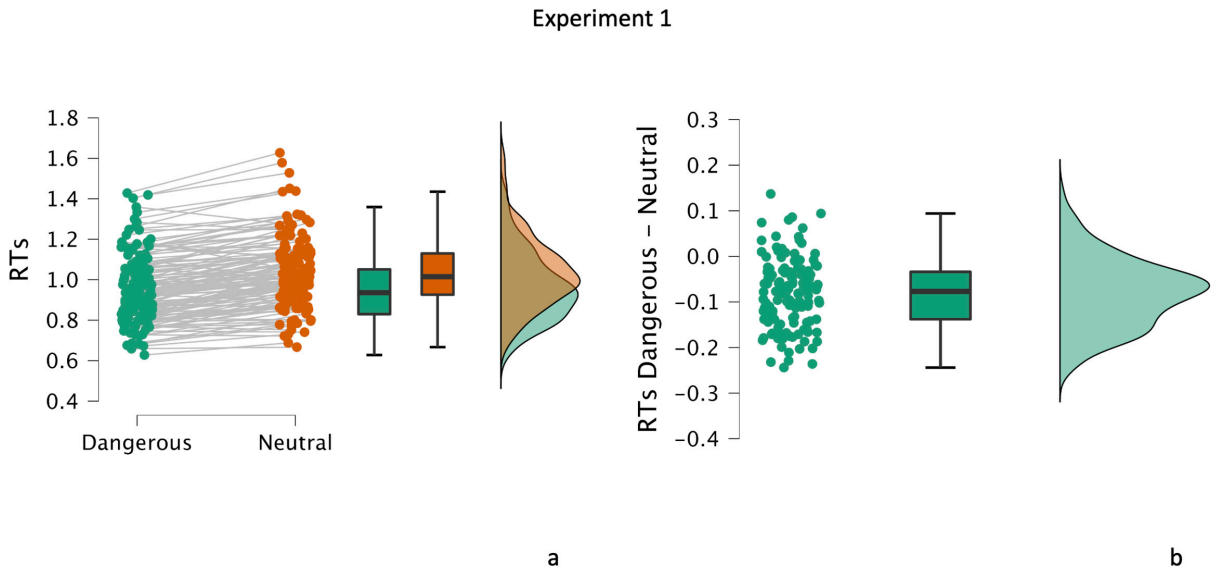

Figure 3. Results of Experiment 1 – Effect of Object Type (individual RTs in the two conditions, panel A; difference between RTs to dangerous and neutral objects, panel B)

Combined effect of Scenario, Perspective and Object Type (Hypothesis 3)

As to the combined effect of Scenario, Perspective and Object Type, we predicted slower responses to Dangerous objects embedded in second- than third-person sentences within the Public Scenario. However, we reported strong evidence in favour of H_0 (BF_{10}=0.04, BF_{01}=26.08), with RTs following second-person sentences only minimally faster (0.942 s) than the third-person ones (0.960 s).

Finally, when considering the difference between Dangerous and Neutral objects within second-person sentences in the Public Scenario the results showed strong evidence in favour of H_0(BF_{10}=0.004, BF_{01}=231). When exploring the effects in the opposite direction, on the contrary, the observed evidence in favour of H_1 was very strong (BF_{10}=7.7e+19) corresponding to average RTs of 0.942 s and 1.098 s for Dangerous and Neutral objects respectively (e.g., "You grasp the handle" vs. "You grasp the toothbrush").

Experiment 2 – German

A total of 115 participants were initially recruited in the experiment. Three participants had a native language other than German and were excluded. Participants having accuracy rates < 90% in the arithmetic (positive control) task were excluded from further analyses (N = 20). Participants having accuracy rates < 90% in critical trials (main task) were excluded from further analyses (N = 7). Three participants having less than 90% of data after we removed errors and outlier reaction times (see below) were also excluded. A total of 82 participants were included in the final analyses (62 female, 19 male; Mean age = 24, SD = 4; see Supplementary Materials for further descriptive statistics).

Effect of Object Type (Hypothesis 1)

When comparing the two Object Types, the directional test bayesian t-test did not show evidence in favour of our hypothesis of slower RTs for dangerous objects compared to neutral ones, while the evidence for H_0 was very strong (BF_{10} =0.004, BF_{01}=254). Average RTs (see Figure 4) to dangerous objects (0.912 s) were indeed faster than to neutral ones (1.035 s). In fact, when exploring the opposite prediction with a further bayesian t-test, very strong evidence was observed in favour of the alternative hypothesis (BF_{10}=1.12e+22).

Effect of Scenario (Hypothesis 2a)

As to the comparison between the two scenarios, we observed strong evidence in favor of H_0, with mean RTs for the Public scenario 0.969 s and 0.975 s for the private one (BF_{10}=0.07, BF_{01}=14.4).

Combined effects of Scenario and Object Type (Hypothesis 2b)

When considering RTs in response to Dangerous objects within the Public Scenario compared to the Private one, we reported strong evidence in favour of H_0 (BF_{10}=0.04, BF_{01}=24.16). In fact, on average responses to the former were only slightly faster (0.902 s) than to the latter (0.922 s).

When addressing the difference between Dangerous and Neutral objects in the Public Scenarios, we report very strong evidence (BF_{10}=0.005, BF_{01}=219) supporting H_0. Indeed, Dangerous objects embedded in Public scenarios yielded faster responses than in the Private one (0.902 and 1039 s, respectively). On the contrary, in an exploratory t-test in the opposite direction, similarly to Hypothesis 1,

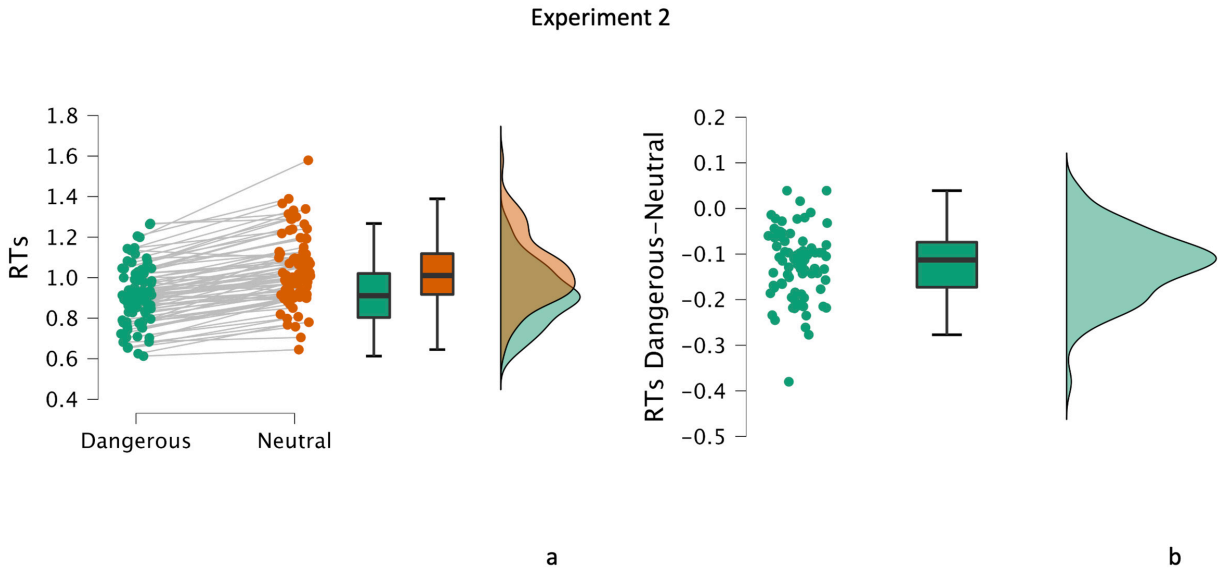

Figure 4. Results of Experiment 2 – Effect of Object Type (individual RTs in the two conditions, panel A; difference between RTs to dangerous and neutral objects, panel B)

we reported very strong evidence in favour of H_1(BF_{10}=1.13e+19).

Combined effect of Scenario, Perspective and Object Type (Hypothesis 3)

When evaluating the combined effect of Scenario, Perspective, and Object Type we predicted slower responses to Dangerous objects embedded in second- than third-person sentences within the Public Scenario. However, the data showed only anecdotal evidence in favour of H_1 (BF_{10}=2.247, BF_{01}=0.45) with RTs following second-person sentences slower (0.916) than the third-person ones (0.887).

Finally, when addressing the difference between Dangerous and Neutral objects within second-person sentences in the Public Scenario we observed very strong evidence in favour of H_0 (BF_{10}=0.005, BF01=191). An exploratory test in the opposite direction indeed showed very strong evidence in favour of H_1 (BF_{10}=4.27e+16, BF01=2.34e-17), with average RTs for Dangerous objects faster than those for the Neutral ones (0.916 and 1.081 s, respectively). In other words, participants responded significantly faster to Dangerous objects than to Neutral ones in Public Scenarios in second-person sentences, in line with the results obtained for H_1.

Exploratory analyses

Further exploratory analyses were performed in order to evaluate the possible role of covariates (such as Age or Gender) in determining the observed effects. All analyses are reported in full in the Supplementary Materials. To address this issue, we considered continuous covariates: Age, Handedness score (EHI), GAD-7 score, COVID-19 New Cases (the number of daily confirmed COVID-19 cases), and Sentence Length. COVID-19 New Cases data were assigned to each participant according to their participation date. Numbers for new COVID-19 cases were taken from Our World in Data (daily new confirmed COVID-19 cases 7-day rolling average; see https://ourworldindata.org/covid-cases). In addition, we included the following categorical covariates: Gender, Living Situation, Housemates' Condition (e.g., at risk or confirmed cases), Prior COVID-19 Infection (see Supplementary Materials).

In Experiment 1, there was an interaction between Gender and Object Type: Analysis suggested a link between participant's gender and the overall effect of faster responses to dangerous as compared to neutral objects. Specifically, the magnitude of this effect appears smaller in females than in males.

In Experiment 2, we notably found this effect of Object Type to be modulated by Age, with larger differences between dangerous and neutral objects in older as compared to younger participants.

Finally, as to the exploratory sample of older participants (over 40), we could not recruit a sufficient number of participants (8 in Experiment 1 and 6 in Experiment 2) to allow further statistical analyses.

Discussion

When testing for the effect of processing different Object Types linguistically, our results show clear evidence for faster RTs in response to objects we classified as Dangerous compared to Neutral objects. This is against our initial hypothesis, in which we predicted a substantial effect in the opposite direction and is comparable in the two Experiments. Other possibilities are open, even if we deem them less likely, also in light of previous evidence. It is possible that these objects differed in some way that contributed to reaction times but was not related to dangerousness.

Notably, however, many previous studies highlighted differences between dangerous and neutral objects using response times as a dependent measure, and the results were consistent with those obtained with other techniques, like EEG. In addition, it is possible that the objects categorized as dangerous were actually perceived as less dangerous than the objects categorized as neutral. If our interpretation is correct, to the best of our knowledge, these results show for the first time that participants are sensitive to the distinction between Dangerous and Neutral Objects when processing sentences and not when perceiving objects or images.

In addition, when considering the effect of the two different Scenarios, we observed only anecdotal evidence in favour of our hypothesis in Experiment 1 and strong evidence against it in Experiment 2. The two Scenarios were thus likely not perceived at different degrees of dangerousness as we were unable to elicit detectable behavioural differences (Experiment 2) and when these differences emerged, they were negligible (Experiment 1).

Further analyses considered the combination of these two factors, that is a possible interaction between the activated Scenarios and the affordances activated by different Object Types. Notably, and in line with the other results, when comparing RTs to Dangerous Objects within the Public and Private Scenarios we report strong evidence in favour of H_0 in both Experiments. The same holds when comparing Dangerous and Neutral Objects in the Public Scenario. Thus, while the response times to the two Object Types clearly differ, this does not appear to be modulated by the Scenario in which they are embedded. It has to be noted, however, that we manipulated Public and Private scenarios by presenting short cover stories before each block and not before each sentence. In addition, participants had to perform a sensibility judgment for which the Scenario was not relevant, i.e., the sentence had to be evaluated *per se* and not in relation to the context in which it was presented. Both these factors have likely weakened our manipulation, either because of its short-lasting effect or its task-irrelevance.

Finally, when addressing the combined effect of the three manipulated factors, in Experiment 1 we report strong evidence in favour of H_0 and only anecdotal evidence for H_1 in Experiment 2 when responses to Dangerous objects embedded in second- vs. third-person sentences are concerned. On the contrary, when analysing the difference between the two Object Types when embedded in second-person sentences, we again found very strong evidence against our initial hypothesis, but an equally strong one when the opposite direction is considered.

Overall, our data show a clear effect of Dangerous objects (see Figure 3 and 4 where data are plotted separately for each participant), and thus perceived dangerousness, on participants' performance. While this was in line with our predictions, the direction of the effect is opposite to the expected one. Strikingly, this effect is present across different Scenarios (Public vs. Private) and to a large extent independently from the sentences (2nd vs. 3rd person) in which the nouns pertaining to the two Object Types were presented. Notably, when exploring the role of other moderating factors, we only found evidence for a possible effect of gender in Experiment 1 and of age in Experiment 2. Namely, the effect of Object Type resulted stronger in males than in females in the former, and in older compared to younger participants in the latter. In both experiments, this might be explained by a stronger perception of the virus dangerousness by male and older participants, respectively, although our sample was in general very young (18-40 years old) and not balance between male and female participants.

As outlined in the introduction, a large body of evidence using visual stimuli and the object categorization task suggests slower responses to dangerous objects as compared to neutral objects. However, a number of studies found an opposite effect, i.e., faster responses to dangerous objects than to neutral objects (e.g., Giocondo et al., 2022; see also Gable & Harmon-Jones, 2010; Kunar et al., 2014; Okon-Singer et al., 2013, 2020). This opposing effect might be explained by the so-called negativity bias, i.e., a facilitation of early attentional processes in the presence of dangerous stimuli (see for review Norris, 2021), followed by interference with motor responses and evaluative categorization at later stages. Indeed, a recent EEG study by Mustile et al. (2021) found that the effect of dangerous affordances might be twofold: in the early processing stages, dangerous affordances facilitate attention (reflected in a larger visual P1 potential). Later in the course of processing, dangerous affordances inhibit motor responses (as shown by a larger frontal N2 potential) and object categorization (reflected in the larger parietal P3b potential). Importantly, Mustile et al. (2021) found these late inhibitory effects of dangerous affordances only in the condition where participants had to reach for the object. In a similar vein, in an EEG study, Kuhbandner et al. (2016) found increased inhibition of irrelevant perceptual processes (i.e., more efficient focusing of attention) but decreased inhibition of irrelevant motor processes (i.e., stronger interference at the response stage) caused by dangerous affordances as compared to neutral stimuli. Thus, it could be that responses to dangerous affordances in our study were facilitated by the initial attentional advantage (negativity bias). At the same time, it is possible that no motor interference or judgment inhibition followed due to the task nature. In this respect, it is worth noting that we used linguistic stimuli, and the task was to perform the sentence sensibility judgement and not to directly focus on the potentially dangerous concept. If it indeed was the case in our study that only the early attentional effect of dangerous affordances emerged but not the later response-related effect, this mechanism would lead to the pattern that we observed, namely, shorter response latencies for dangerous as compared to neutral stimuli.

More distant but still relevant is the research on the impact of emotional information on language processing. Findings on this issue seem to be mixed. Some studies suggest that emotional experiences associated with words might have inhibitory effects, i.e., such experiences are associated with slower responses in lexical decision and naming tasks (Estes & Adelman, 2008; Larsen et al., 2008; see also Siakaluk et al., 2014). However, a larger body of evi-

dence demonstrates a facilitatory effect of emotional information on lexical processing. Emotional information was found to facilitate responses in naming of abstract words (Moffat et al., 2014) and word processing in a lexical decision task (Siakaluk et al., 2016; see also Lund et al., 2019; Vinson et al., 2014). Emotional information seems to facilitate lexical processing regardless of the quality of the emotion, i.e., both positive and negative words are processed faster than neutral stimuli. There is even evidence that processing negative words might particularly benefit from higher emotional arousal (see Robinson et al., 2004; cf. Larsen et al., 2008; Palma de Figueiredo, 2015; but see Kauschke et al., 2019; Vinson et al., 2014). Since we did not include positive stimuli in our study, we cannot disentangle effects of danger and emotionality or emotional arousal. It could be that faster responses to dangerous stimuli emerged due to higher emotional arousal resulting from simulating negative affordances, and a similar facilitation could have taken place in response to positively arousing stimuli.

Limitations

This study has some limitations that could be addressed in further research. First, while online data collection allowed us to recruit a large number of participants in two countries, this comes with inherent limitations. The robustness of our results should thus be tested further in a laboratory setting, possibly with the inclusion of additional measures like EEG. Second, most of our data were collected in summer (mostly July) 2020 thus providing a snapshot of a very specific time window of the pandemic. Particularly, at the time the general population was still heavily influenced by information regarding the role of direct physical contact and fomite transmission in the spreading of the virus, and evidence regarding airborne transmission was still not widely acknowledged. Further follow-up research with the same participants, or a replication of our original study, could provide useful information on how the effects we reported evolved over time. This would likely allow to test for a third limitation of our study, namely addressing the distinction between dangerous objects and objects negative in valence. Further studies should be implemented in order to understand whether the effects we found concern specifically the distinction between dangerous and neutral objects or can be generalized to stimuli differing in valence.

Conclusions

In two pre-registered online experiments conducted in Italy and Germany we report how linguistically processed affordances (e.g., nouns) modulate motor response in a sensibility judgment task. These results show how everyday social objects (e.g., a door handle) were perceived as potentially dangerous at the height of the COVID-19 pandemic, as shown by the comparison with neutral, typically private, objects (e.g., toothbrush). Notably, this effect appears quite pervasive as it occurred across various contexts and in both experiments with equal strength of observed evidence. Future studies are required to further clarify whether the pattern of results for dangerous affordances follows the more general pattern for negative words and to examine whether the effects of dangerous affordances differ between objects/words with immanent negative properties (like spider or fire) and objects/words whose potentially negative properties (e.g., risk of contamination) emerge only in certain contexts. Finally, future replications of this paradigm might clarify whether this effect was only temporary (e.g., at the height of the pandemic or soon afterwards) or whether it produced more permanent behavioural changes.

Author Contributions

Contributed to conception and design: CG, AB, NC, AM, KK, MJ

Contributed to acquisition of data: CG, KK

Contributed to analysis and interpretation of data: CG, KK, AM

Drafted and/or revised the article: CG, KK, AM, MJ, NC, AB

Approved the submitted version for publication: CG, KK, AM, MJ, NC, AB

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Competing Interests

The authors declare no conflict of interest.

Data Accessibility Statement

The study was pre-registered on the Open Science Framework (OSF, https://osf.io/7bh8s). All the information given in this paper, as well as all the materials and data, are shared on the project page on OSF (https://osf.io/PZGFX/).

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