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Valenced Media Effects on Robot-Related Attitudes and Mental Models: A Parasocial Contact Approach

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Abstract

Despite rapid advancements in robotics, most people still only come into contact with robots via mass media. Consequently, robot-related attitudes are often discussed as the result of habituation and cultivation processes, as they unfold during repeated media exposure. In this paper, we introduce parasocial contact theory to this line of research—arguing that it better acknowledges interpersonal and intergroup dynamics found in modern human–robot interactions. Moreover, conceptualizing mediated robot encounters as parasocial contact integrates both qualitative and quantitative aspects into one comprehensive approach. A multi-method experiment offers empirical support for our arguments: Although many elements of participants' beliefs and attitudes persisted through media exposures, valenced parasocial contact resulted in small but meaningful changes to mental models and desired social distance for humanoid robots.

Keywords: parasocial contact, social robots, mental models, social distance, media effects

Introduction

Social robots—(semi-)autonomous machines with the ability to simulate human sociality—are increasingly entering human social spheres. Contemporary innovators envision such machines in an ever-growing number of roles and positions, from robotic health

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care providers, teaching assistants, and coworkers in assembly lines, to friendly hotel concierges handing over room keys. Despite these many potential integrations, however, most people still only encounter social robots through media representations; for example, as part of television shows, documentaries, or movies (Mara et al., 2021; van Oers & Wesselmann, 2016). In turn, scholars have suggested that the future adoption of robots may critically depend on how media portrayals shape attitudes and impressions prior to actual adoption opportunities (e.g., Banks, 2020; Savela et al., 2021).

Importantly, the conditions and processes that give rise to media-facilitated impression formation for robots—especially those of a humanlike design—are only vaguely understood. While some exploratory studies have indicated that different types of robot depictions in the media may shape viewer attitudes accordingly, their strictly empirical approach provided only few theoretical reference points to make sense of the examined effects (e.g., Bruckenberger et al., 2013). In response to this shortcoming, more recent literature has discussed robot-related media influence through the lenses of habituation and cultivation (i.e., as the stepwise adjustment of people's mental models according to repeated mass-mediated encounters; e.g., Banks, 2020; Sundar et al., 2016; Young & Carpenter, 2018). As such, scientific focus has rested mainly on the *quantity* of robot representations in media, but not yet on their *quality*. Although understanding exposure quantity is useful, it is incomplete and must be accompanied by unpacking qualitative aspects as well. In the current study, we begin to address that gap by building on the *parasocial contact hypothesis* (Schiappa et al., 2005)—the idea that biases toward dissimilar others can be alleviated by positive, counter-stereotypical media exemplars. Using scenes from famous movies and television shows to create experimental conditions that represent positive vs. negative parasocial contact with humanoid social robots, we investigate changes in participants' mental models as well as their subsequent behavior toward a real-life robotic machine. We employ a mixed-method approach combining an inductive exploration of people's before- and after-contact mental models with deductive testing of whether parasocial dynamics transfer to robots. In doing so, we find that even limited parasocial exposures can have small but meaningful changes to how one thinks and feels about robots that look human and/or behave in a human-like way.

Interpersonal and Intergroup Dynamics in Human-Robot Interaction

People often perceive and react to social robots as if they were human (e.g., Spatola et al., 2019; van Straten et al., 2020), but robots are also seen as a distinct *kind* (Banks & Koban, 2022; Kahn et al., 2011). Consequently, engaging these robots may no longer be a question of mere technology acceptance but rather the result of complex interpersonal and intergroup processes.

Interpersonal processes encompass cognitions, emotions, and behaviors that occur face-to-face, including impression formation, stereotyping, or relationship development. Although caution has been urged against overgeneralizing *all* interpersonal theories as transferrable to human–machine communication (Fox & Gambino, 2021), research suggests that parallels are frequent, especially once robotic machines look or behave distinctly human-like (e.g., Lee et al., 2006; Stein et al., 2022). While the mechanisms underlying these parallels are not yet well-understood, one potential explanation lies in people's automatic social-cognitive processes. In particular, both humans and robots seem to evoke similar mentalizing processes in observers—that is, people may automatically infer the mental states of both types of entities and use those inferences to interpret behaviors (e.g., Airenti, 2015; Banks, 2021). Accordingly, users may develop genuine empathy and emotional attachment toward robotic machines, which further prompts them to treat the machines as social actors.

Secondly, interactions with robots may parallel those with humans as they aggregate, identify, and differentiate among one another (i.e., as they follow conventional principles of *intergroup behavior*). In this domain, *ingroups* are defined as social groups with whom one identifies (e.g., peer group, family, community), whereas *outgroups* are all other social groups that do not elicit such identification. Because people perceive robots as social entities yet also as ontologically different from themselves (Kahn et al., 2011), they are likely to be categorized as a distinct social group (e.g., Smith et al., 2021). In turn, intergroup dynamics may come into effect (cf. Tajfel et al., 1979): Whereas the human ingroup is typically perceived in a favorable light, the robotic outgroup may be met with apprehensiveness and devaluation (e.g., Vanman & Kappas, 2019). Indeed, these ingroup–outgroup biases seem to be particularly evident once people encounter highly homogenous robot groups (Fraune et al., 2017) or expect available resources to be limited (Jackson et al., 2020)—as these conditions heighten perceptions of self-dissimilarity and competition. In a similar vein, Gamez-Djokic and Waytz (2020) connected concerns about robotic automation to both realistic and symbolic outgroup threats, including the loss of jobs and dominant cultural values. This further illustrates that, regardless of robots' increasing sophistication and usefulness, people might ultimately remain wary of the robotic *other*.

Intergroup Contact as a Way to Mitigate Outgroup Bias

For developers, marketers, and researchers of robotic technology, such intergroup dynamics raise a crucial question: How do outgroup biases toward robots impact human–robot interactions? On the one hand, given automation's potential to enhance human life, minimizing outgrouping and fostering ingrouping could promote social and functional acceptance (e.g., collaboration or social harmony). On the other, some have argued that humans should limit their anthropomorphization of robots and keep robotic simulations of sociality from tapping into preconscious drivers of actual sociality (e.g., Bryson, 2010). From both perspectives, it is critical to understand group-relevant biases—whether to support or suppress social integration.

We focus here on relevant theory that may help to explain dynamics of robot social acceptance despite their outgroup status, with particular inspiration taken from social psychological literature. The *contact hypothesis* (Allport, 1954) proposes that intergroup relations can be improved through guided facilitation of positive outgroup contact, depending on several relational and contextual factors. For example, contact between two groups may be particularly effective at reducing bias if both parties are of equal status, strive for a common goal, and are guided by positive norms (Allport, 1954; Pettigrew & Tropp, 2006). Moreover, the presentation of counter-stereotypical characteristics is said to be particularly beneficial in terms of contact effects—it prompts observers to dismiss (biased) group-level perceptions in favor of more individualized judgments (Taschler & West, 2016). At the same time, a *negative contact hypothesis* must be considered (Meleady & Forder, 2018): Unpleasant or stereotype-confirming interactions can instead lead to stronger prejudice and aversion. Apart from this limitation, however, empirical evidence anchors contact dynamics as a highly effective means to improve social-group relations (e.g., Pettigrew & Tropp, 2006).

Inspired by these notions, HRI scholars have started to wonder if intergroup contact may similarly reduce bias toward robots as an outgroup. Their work showed that neutral in-person encounters with a robot significantly reduced the psychological distance participants felt toward social robots as an ostensible outgroup (Haggadone et al., 2021), in line with prior work demonstrating that evaluations of robots improve after repeated in-person interactions (e.g., Haring et al., 2015). Notably, however, past work has largely framed such observations as the result of *habituation* (i.e., as a less aversive response following uncertainty reduction; e.g., Koay et al., 2007). Although such desensitization effects are also incorporated in intergroup contact theory (e.g., Pettigrew & Tropp, 2006), the contact hypothesis reaches notably further: It assumes that face-to-face contact not only breaks down negative expectations, but also helps to replace stereotypical cognitions with more individualized or even counter-stereotypical perceptions (Allport, 1954). In this sense, contact between social groups may ultimately serve to correct "hasty generalization[s] made about a group based on incomplete or mistaken information" (Schiappa et al., 2005, p. 93).

From Direct to Parasocial Contact

A modification of Allport's (1954) original conception, the *parasocial contact hypothesis* (PCH), presumes that intergroup contact does not necessarily have to be synchronous and co-present in order to elicit bias reduction (Banas et al., 2020; Schiappa et al., 2005). Instead, mass-mediated contact with a depicted outgroup (e.g., watching minority group portrayals on television) could also exert a meaningful positive influence on people's attitudes—an effect grounded in the notion of *parasocial interactions* (PSIs; Horton & Wohl, 1956).

PSIs were initially understood as a form of perceptual "illusion" (Horton & Wohl, 1956, p. 215) occurring during television consumption: Despite exposure to televised characters being operationally one-sided (i.e., the character speaks to the audience and is heard, but communication cannot be reciprocated), viewers may perceive it to be reciprocal—and even react accordingly (e.g., by talking back to the character). From this initial conceptualization, the construct was later complemented by the notion of *parasocial relationships* (PSRs; i.e., overarching feelings of relatedness that emerge across multiple interactions). Taken together, both parasocial phenomena are now commonly understood as a complex set of cognitive, affective, and behavioral responses during and after media reception, by which a nondialectical, imaginary connection feels dialectical and quite real (e.g., Liebers & Schramm, 2019). Moreover, parasocial experiences tend to resemble everyday social ties in profound ways, for instance offering similar gratifications and triggering similar social judgments (e.g., Tukachinsky & Stever, 2019). Thus, the effects of parasocial contact may mirror those of traditional face-to-face contact as both are based on the *perception* of meaningful interpersonal connections.

Highlighting the validity of the PCH, a recent meta-analysis (Banas et al., 2020) synthesized 79 studies on parasocial contact, reporting a notable decrease in various outgroup biases following exposure to positive group depictions ($r = -.23$). A reverse effect was also found, as negatively valenced outgroup portrayals led to worse attitudes among participants ($r = .31$). The meta-analysis further revealed that there was no significant difference between mediated and vicarious contact (i.e., passively observing group interactions in real life), underscoring the vivid nature of encountering outgroups via media. Importantly, this equivalence of contact modalities was also observed for human–robot interactions: In a recent field experiment, evaluations of a social robot were not significantly different when encountering it in person or via 2D or 3D screens (Mara et al., 2021; cf. Li, 2015).

Mediated Robot Encounters as Parasocial Contact

Given initial evidence that intergroup dynamics may extend to robots as an ostensible outgroup, a vital next step for human-machine communication theory is to scrutinize mass-mediated robot exposure as part of the PCH framework. We argue for this framing because PCH accounts for two important limitations of past approaches in ways that still allow for the synthesis of extant findings (e.g., Banks, 2020; Bruckenberger et al., 2013; Savela et al., 2021; Sundar et al., 2016; Young & Carpenter, 2018).

First and foremost, prior approaches rely most heavily on notions of habituation (as detailed above) and on cultivation theory (e.g., Banks, 2020; Sundar et al., 2016)—the idea that repeated mass media exposure shapes viewers' mental models according to often similar, stereotypical group representations (Gerbner & Gross, 1976). Importantly, habituation and cultivation can be applied effectively to *any* focal object or phenomenon (e.g., cultivated understanding of crime or education or even rocks); which means that neither approach accounts for the [simulation of] sociality inherent to human-machine communication. Parasocial contact theory specifically considers the dynamics of social ties, including processes by which trust, liking, and attraction emerge. It further encompasses vicarious learning (Bandura, 2009), another socially informed mechanism yet unaddressed through the habituation or cultivation approach. Crucially, we underscore that the PCH does not *preclude* processes inherent to those perspectives—instead, it offers a more comprehensive framework for integrating those perspectives with person perception and intergroup dynamics.

Secondly, the PCH framework covers both quantity and quality of exposure, building on a large body of evidence regarding beneficial and detrimental contact conditions (Allport, 1954; Banas et al., 2020; Żerebecki et al., 2021). In turn, this further allows it to offer clear suggestions as to how mediated group portrayals may evoke positive or negative effects. Particularly, it reframes exposure to media representations as one that is experienced as *actual and social*, so that phenomenological processes inherent to interpersonal and intergroup dynamics become the focal mechanisms. Moreover, even though research suggests that parasocial contact may profit from repetition and prolonged duration (Żerebecki et al., 2021), its benefits can even unfold after single and brief interactions (e.g., Schiappa et al., 2005). As such, the PCH appears to be particularly well-suited to inform empirical efforts applying both time-zero and longitudinal methodologies.

The Current Study

At this point, the open question is: (How) do qualitative properties of robot depictions in media causally impact people's understandings of and attitudes toward members of that group? We address the question of *understanding* through the lens of mental models (MMs)—cognitive structures resulting from the internalization of external phenomena, which serve as frames for interpreting immediate experience (Craik, 1943). MMs contain tokens of knowledge representing things abstract or concrete, more or less like the actual phenomenon, and are informed by indirect or direct exposures to the thing itself (see Banks, 2020). With respect to knowledge about robots as a group, media representations have the potential to convey depictions of robots that reinforce existing understandings, to disrupt them, or to shift how those understandings are evaluated. Thus, we built the exploratory portion of this investigation around the following core research question:

> **RQ1**: (How) does viewing positive (vs. negative) robot media portrayals affect participants' mental models for robots?

In addition to exploring the influence of parasocial contact on MMs, however, we also aimed to find out whether the known impact of parasocial contact on outgroup *attitudes* would carry over to robots. For this research interest, we complemented the exploratory work with a theory-driven, deductive approach, considering attitudinal outcomes.

In line with extant evidence on how positive and negative parasocial contact affects attitudes toward human outgroups (Banas et al., 2020), we first considered potential effects on people's preferred social distance—a common concept of attitudinal bias and core variable in contact theory (e.g., Ortiz & Harwood, 2007). We predict:

> **H1:** Viewing positive (vs. negative) robot media portrayals will lead participants to prefer less (a) physical distance, (b) relational distance, and (c) conversational distance to an actual social robot.

We secondly operationalize attitudes toward robots in accordance with extant evidence about fundamental social judgments. Specifically, people are understood to heuristically judge other humans according to *warmth* (i.e., a caring, emotive, and helpful nature) and *competence* (i.e., the ability to pursue goals intelligently; Fiske et al., 2007). This fundamental taxonomy is foundational to stereotyping and evidence indicates that it is also used for judging humanoid robots—typically involving attributions of moderate-to-high competence and low levels of warmth (e.g., Carpinella et al., 2017), although some morphological variants might vary on these evaluations (e.g., domestic robot devices; Reeves et al., 2020). As media depictions of robots tend to rely heavily on warmth and competence for character development—often stereotypically cold or counter-stereotypically warm—we expect that qualitative differences in media portrayals would respectively reinforce or disrupt stereotypical expectations for an actual robot. Focusing on the warmth dimension as a particularly important cornerstone of robot-related perceptions, we hypothesized:

> **H2:** Viewing positive (vs. negative) robot media portrayals will lead participants to perceive an actual social robot as significantly warmer.

In tandem, we contemplated how people's impression of competence might be affected. On the one hand, a helpful, friendly robot might also be perceived as more competent due to its high socio-emotional functionality; on the other, competence (in the sense of *calculating* agency) could be considered as a counterpoint to displays of warm and communal behavior. As such, we pose an open research question regarding this concept:

> **RQ2:** Will viewing positive (vs. negative) robot media portrayals lead to significantly different competence perceptions about an actual social robot?

Method

To address the posed research questions and hypotheses, a two-condition experiment was conducted and analyzed using a multimethod approach. All study materials are available in online supplements (https://osf.io/2qtc4/) and hypotheses and analysis plan were pre-registered (https://aspredicted.org/3TM_9G5). For transparency, we must note deviations from that pre-registration due to unforeseen circumstances: A combination of unusually low study enrollment for this laboratory experiment (a trend continuing from the height of COVID-19), and participant harassment of lab staff required early closure of the study. Thus, the pre-registered sample size of 126 (to detect moderate effects of Cohen's *d* with 80% power) was not met, so low power for statistical analysis is acknowledged as a limitation of this investigation. Specifically, a post-hoc power analysis showed that with the achieved sample size, group differences of medium effect size could only be detected with a reduced power of 67.0%; results should be considered with this limitation in mind.

Participants

N = 77 participants (age M = 28.26 years, SD = 13.60; 49 identifying as female, 28 male) were recruited from a southwestern US university and its surrounding community. They were invited to participate in a two-part study on "perceptions of robots in the media and in the world," incentivized by entry into a drawing for a US$100 Amazon gift card. This recruitment approach garnered an age-diverse sample (18 to 74 years); however, since age and student status did not appear to correspond with any variables of interest (see online supplements), the two groups are here analyzed and reported in aggregate.

Procedure

The study's two-part design comprised an online survey followed by an in-person lab session. The initial survey (hereafter time *T1*) established a baseline for pre-stimulus understandings of and attitudes about robots—namely, participants' mental models for, desired social distance from, and stereotype content (i.e., warmth and competence perceptions) for robots (see Measures section). Upon survey completion, participants were redirected to an online system to sign up for an in-person laboratory session. After scheduling, the session (of one to three participants) was randomly assigned to one of two experimental conditions (positive or negative parasocial contact). Participants were not primed with notions of goodness or badness or made aware of condition assignment, so that any effect would come from the stimulus content itself.

In the lab session (time *T2*) participants were welcomed to a film screening room, given instructions, and then presented with either a positive or negative film reel per the randomly assigned condition (see Stimuli section). Following this treatment, participants completed a tablet-based digital survey, indicating robots they had recognized in the film and, mirroring *T1*, again responding to robot mental model elicitations. Then, they were led to another room to observe a scripted interaction between the experimenter and an actual robot. Finally, participants returned to the tablet survey to again complete the social distance and stereotype content measures, with instruction to consider the actual robot (instead of robots in general).

Stimuli

Parasocial Contact (Positive or Negative Media Treatment)

To create media stimuli for our manipulation of parasocial contact, we consulted several hallmark publications as detailed in the literature review and engaged that literature in an in-depth discussion between both authors. We specifically focused on fundamental aspects of what may be counted as positive vs. negative outgroup contact—and in particular on those characteristics that seemed suitable for extraction from brief segments of existing films. Doing so, we settled on three criteria for comparing positive vs. negative depictions: (1) Emphasizing counter-stereotypical (e.g., warm, communal) vs. stereotypical (e.g., cold, agentic) aspects of the outgroup, (2) suggesting shared vs. diverging group goals, and (3) depicting cooperative vs. competitive behaviors (as an indicator for interdependent vs. independent intergroup dynamics). Moreover, informed by the reviewed literature on the formation of PSIs, we decided to limit the positive contact stimulus to depictions that were overtly likable, sociable, or sympathetic—whereas the negative condition could also involve more sinister or downright threatening portrayals. These conceptual decisions align with the abovementioned focus on the impact of warmth perceptions for human–robot interaction (HRI); while we deemed it suitable for robots in both media conditions to appear more or less competent, only the machines in the positive parasocial treatment were supposed to be seen as warm and helpful.

Having assembled these theoretical criteria, we conducted a search of robot-related media in television and cinema—consulting the International Movie Database (IMDB) and several journalistic reviews (e.g., Wold, 2021). This produced a catalog of candidates for both conditions. We excluded the 50 most popular movies and television shows (based on box office and viewer counts) to minimize any effects from heuristic familiarity or popular discourse. We also excluded robots from animated movies (e.g., *Wall-E, Baymax, Iron Giant*) to avoid diminished realism, as well as those with a non-humanoid design (e.g., *AMEE, Johnny Five*)—keeping in mind that perceived similarity to one's (human) self has been identified as a main predictor of successful PSI formation (Liebers & Schramm, 2019).

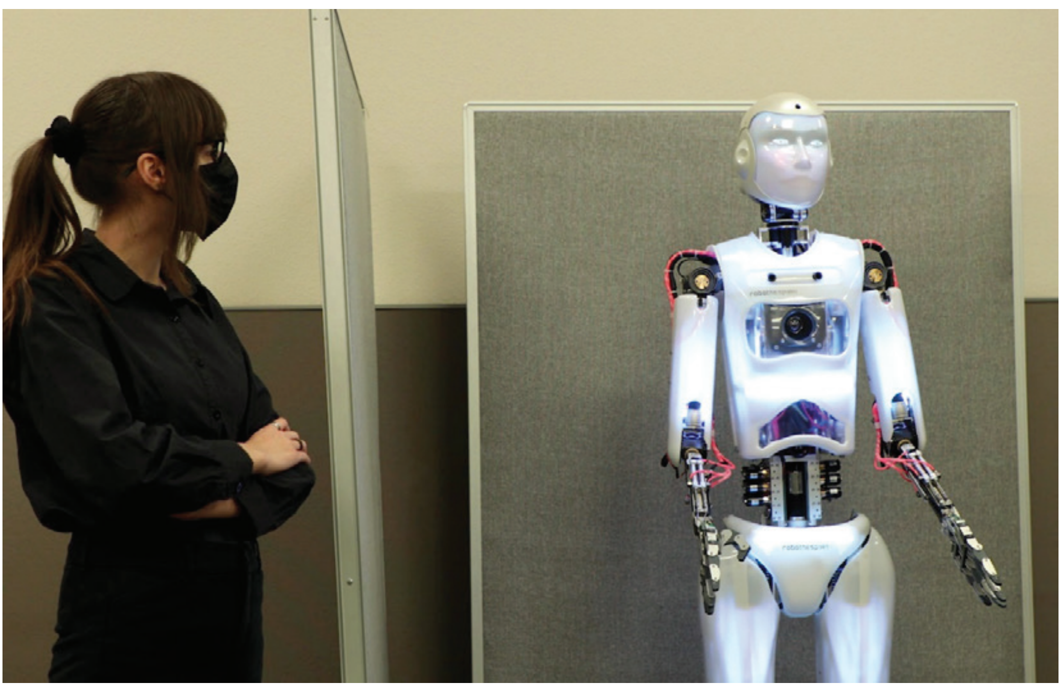
Based on the narrowed selection of eligible characters, we carefully matched exemplars on those criteria to create two contrasting film reels (positive vs. negative parasocial contact), each a montage of 15 scenes from different movies and television shows. Despite presenting different tonalities, group dynamics, and attributes, both reels contained robots with similar designs and levels of human-likeness, as well as the same number of female-coded and male-coded robots. Moreover, both montages ranged in cinematic age, from the first half of the 20th century to the 2010s. Lastly, scenes contained similar numbers of human–robot interactions and reached a similar runtime (positive reel: 715 seconds; negative reel: 769 seconds), though we privileged content parity over length parity as core to the manipulation. After the reels were constructed, undergraduate research assistants (at that point naïve to the aims of the manipulation) confirmed face validity of the positive/negative manipulation. The full storyboards and videos (as well as a detailed overview of our theoretical and design choices) can be found in the online supplements.

Encounter With an Actual Robot

For the actual robot encounter, we settled for a standardized, *observed interaction* between a human confederate and the humanoid robot "Ray"—so as to avoid the disruptive influence of different conversation topics, levels of emotionality, or nonverbal cues as they might have occurred in individual, organic interactions. Ray is a *RoboThespian 4* (Engineering Arts, U.K.) that stands 175 cm (5 feet, 9 inches) tall, is able to move its head and arms, and is stationary from the waist down. Ray was presented as female via the Socibot facial projection (female version "Pris") and American English voice (female version "Heather").

In the prepared interaction, the confederate was a White adult female wearing black clothing and a black mask (Figure 1). She was trained to perform the script as an interview with Ray as a way to introduce the robot to the "guests." A separate confederate controlled

FIGURE 1 Interaction Between the Experimenter and the Social Robot During the In-Lab Session



the robot's (non-)verbal behaviors from an adjacent room (i.e., *Wizard-of-Oz* technique). To keep this in-person encounter as neutral as possible—such that performed positivity or negativity would not override any effect of the experimental stimuli—the dialogue involved neither overly friendly nor unfriendly passages. Instead, Ray described her daily work and gave some basic information about her attributes and functionalities. At the end of the 4-minute interaction, the experimenter requested the robot to go back to "idle mode" and obscured it with a partition. See the project's OSF directory for the full script.

Measures

Mental Model Elicitations

Mental models are understood to be black boxes—people may or may not be aware of knowledge they hold about a phenomenon, and the task of understanding a mental model requires motivating people to externalize their internal knowledge and beliefs while not influencing the content of those externalizations. To achieve this, we adapted an approach from Banks (2021) in posing three elicitations to motivate externalizing of participants' understandings of robots. At both *T1* and *T2*, participants were asked to "In your own words, please explain": (1) ". . . what 'robots' are," (2) ". . . what robots can do," and (3) "your ideas about the roles that robots should play in society." Participants were instructed to think about robots as they exist in the real world, and to provide as much detail as they can.

Quantitative Measures

Desired Social Distance. To measure general attitudes toward (a member of) the robotic outgroup, we used three items capturing desired social distance (Banks & Edwards, 2019). Constituting three distinct facets of approach/avoidance, these items address the desired (a) *physical distance*, (b) *relational distance*, and (c) *conversational distance* to robots. For each Guttman-scaled item, six gradation points were presented to capture participants, comfort with degrees of distance (e.g., physical distance: "I would be comfortable if a robot was . . .," with options "standing next to me," "in the same room," "in the same building," "in the same city," "in the same country," or "none of the above"). As such, higher values (1–6) denote greater preferred social distance. The *T1* measurement addressed robots in general, and *T2* application captured attitudes about the actual robot they had just met.

Stereotype Content. Situating our work in the well-established stereotype content model (Fiske et al., 2007), we employed two scales for perceived *warmth* and *competence* of robots (Liu et al., 2021). Both measures (warmth: 4 items, e.g., "caring," "good-natured"; competence: 5 items, e.g., "intelligent," "competent") were presented in a 7-point Likert format. Again, the instruction was slightly varied between repeated measurements—*T1* addressing robots in general and *T2* the encountered robot in particular. We observed acceptable internal consistency for all applications, Cronbach's α ranging from .72 to .90.

Control Variables and Manipulation Check

At time *T2*, we additionally captured potentially relevant control variables. Firstly, participants were asked to indicate all robots that they recognized in the movie reels from a list of names. Since this list included all robots from both the positive and negative media conditions, we subsequently calculated each participant's *recognition score* as the number of correctly identified robots minus the number of incorrectly identified robots. At the end of the survey, a manipulation check item asked participants whether the robots they saw were "good" or "bad." As only four participants answered this question in a way that did not match their assigned condition, we deem our manipulation of positive vs. negative parasocial contact as sufficiently valid. Lastly, participants were asked whether they had ever before encountered the in-person stimulus robot (which was answered affirmatively by seven participants). Yet, for all of these control and manipulation check items, exploratory analyses showed that removing the respective individuals did not significantly alter our results (see OSF online supplement), so that all participants could be included in our main analyses.

Results

All obtained data and analyses codes are available in this project's OSF directory.

Media Influences on Mental Models for Robots (RQ1)

To first address RQ1—whether exposure to valenced film depictions of robots may influence mental model content—an *inductive thematic analysis* was conducted by the second author in three stages. In the first, a semantic network analysis tool (Leximancer) was used to induce clusters of co-occurring words within the data corpuses (one each for *T1* aggregated, *T2* positive condition, *T2* negative condition). In the second, those clusters were interpreted as representing higher-order themes by iteratively tacking back-and-forth among the concept map depicting the latent concepts and their associations within themes (Figures 2–4), the thesaurus of words underlying each concept, and the source data from which those words were extracted. In doing so, interpretation was aimed at discerning patterns in the concepts independently and then collectively represented by the key terms, ultimately extracting the overarching concept represented in the clusters. To this end, themes that were manifestly similar across the data sets were flagged as such, and then remaining themes were evaluated—first for conceptual similarities and then for hierarchical relations (e.g., lower-order concepts being associated with higher-order concepts). To ensure interpretations of (dis)similarity did not run too far afield from source data, this process included a return to the keywords and then source data to validate inferred associations and divergences among themes. In the third stage, a qualitative comparison was made among interpreted themes between the *T1*, *T2*-positive, and *T2*-negative theme sets. This inductive analysis is conducted at the *group* level, such that claims made are specific to the overarching patterns within each group (aggregate or condition-specific) at a specific point in time (*T1*, *T2*) and not about any one individual. The analysis narrative with details about the data preparation, Leximancer settings, and the interpretive process are available in the OSF online supplements.

Throughout, *concept* refers to the latent idea manifested in the data as induced by the software; a latent idea is predicted from multiple terms and the heaviest weighted (i.e., most predictive) term is the concept name. *Cluster* refers to induced set of concepts that tend to co-occur within a particular participant's response. *Theme* is the researcher-interpreted meaning of the cluster. *Hits* refers to the number of data units associated with a theme.

Identification of Themes

***T1* Themes (All Participants).** *T1* themes were derived from the aggregated responses (i.e., for all three questions) from all participants. In Stage 1 (semantic network mapping), analysis induced 14 clusters comprising 29 latent concepts (hit range 9 to 173; Figure 2). In Stage 2 (theme analysis), clusters were interpreted to represent (from most to least prevalent): relations to humans, benefits, designed functions, applications, potential to improve human lives, potential to take human jobs, roles in society, status as technology, grounding in artificial intelligence, evolving influence in society, everyday computers, capacity boundaries, characterizing contemporary operation contexts, and individual judgments about robots. See Table 1 on pages 167 and 168 for theme definitions and illustrative data excerpts.

FIGURE 2 Semantic Network Map for the *T1* Aggregated Responses to Robot Mental Model Elicitations

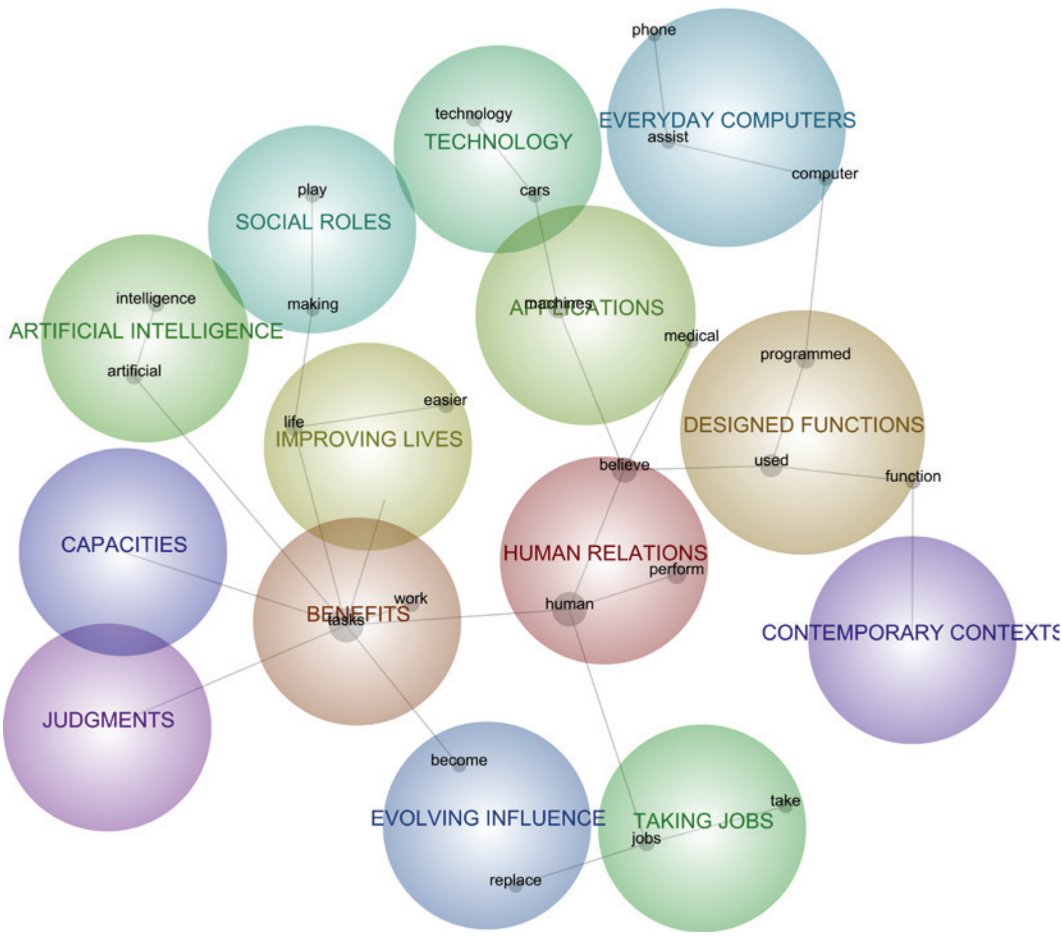


TABLE 1 ***T1* Themes in Participant Characterizations of Robots**

Theme Label	Concepts	Hits	Description	Example Data Extract
Human Relations	Humans, believe, perform	173	Situatedness of robots in relation to humans, especially differences between or alignments with them.	I *believe* robots should be used for good causes like helping the elderly and *people* with disabilities to *perform* daily mundane tasks like cooking …
Benefits	Tasks, work	169	The beneficial outcomes manifested by robots' work.	… [robot labor] can help direct human effort and manpower to other *tasks* that require brain *work*.
Designed Functions	Used, programmed, function	98	Having functions (general or specific) designed by humans.	… robots are *programmed* to do what the creator [intends] … like performing simple *functions* as opening a can of beans. Even other *uses* …
Applications	Machines, medical	62	Examples or lists of how robots do or could play a role in everyday situations.	… they are used for *medical* purposes, but I don't know how. I think bomb squads use *machines* …
Improving Lives	Life, easier	58	Robots can, should, or might improve human lives by making them easier.	… I think robots should exist … to make human *life easier* …
Taking Jobs	Jobs, take	36	Possibility or likelihood that robots will take human jobs.	… there has been much talk about if robots will *take* people's *jobs* …
Social Roles*	Play, making	34	Robots' general role in society, usually linked to making human life easier.	… they can … *play* the role of *making* life easier …
Technology	Technology, cars	33	Are technologies, or can create, contain, or be contained in other technologies.	…. *technology* advances all the time. They're used in manufacturing where robots work on things like car assembly …
Artificial Intelligence	Intelligence, artificial	29	Based on, contains, or functions through AI.	Robots are machines that mimic humans through *artificial intelligence* …
Evolving Influence	Become, replace	28	Are becoming, resulting in increasingly impactful through role displacement or augmentation.	… will continue to *become* more prevalent in the world. I believe they will *replace* many low wage jobs …
Everyday Computers	Computer, assist, phone	26	Are computer assistants already in everyday life.	… even *assisted* in children's education … We utilize robots in our everyday life … The *computer* I'm typing on is leagues smarter than me. The *phone* in my pocket …

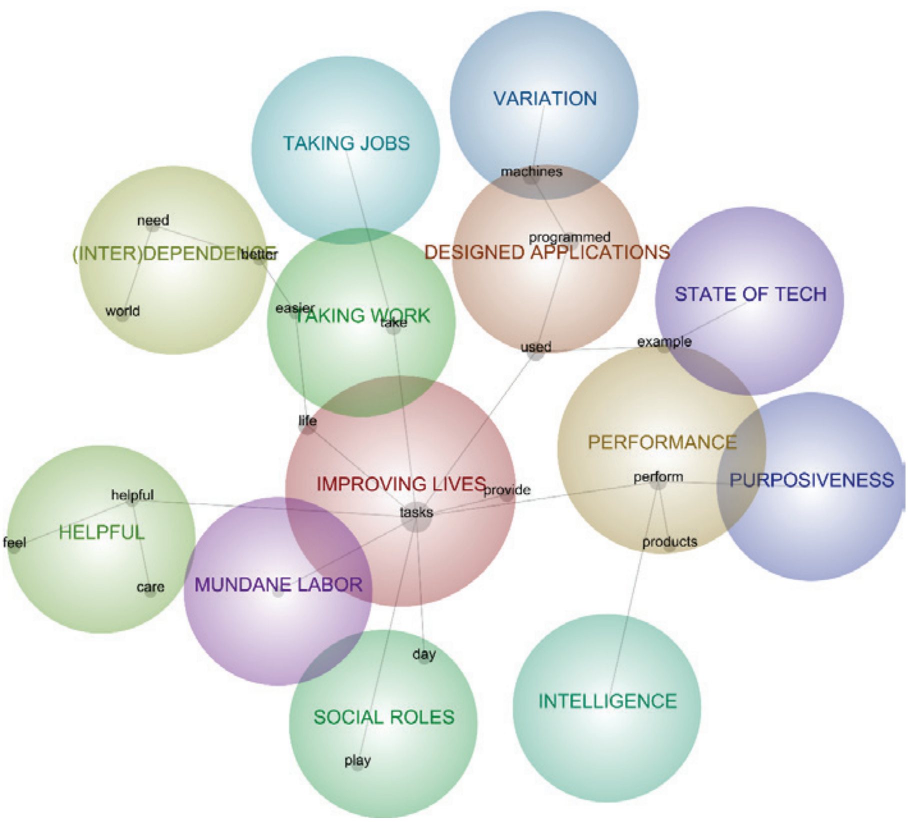
Theme Label	Concepts	Hits	Description	Example Data Extract
Capacity Boundaries	Able	18	Have possibilities and constraints in their abilities.	… should *never* be *able* to think for themselves too.
Contemporary Contexts	World	16	Zeitgeist that robots operate in or help to create, usually negatively valenced.	… the last thing people need in this *world* …
Judgments	Feel	13	Expressed feelings about robots' integration (usually negatively valenced).	… it *feels* like a slippery slope and it's difficult to see clearly where it will lead …

Note: *Theme is interpreted to be an unexpected artifact of the elicitation that could not be avoided through term exclusion; it is removed from further analysis.

***T2* Themes (Positive and Negative Media Conditions, Separately).** *T2* themes were derived from aggregated responses to all three elicitations for each condition-specific group separately, that is, those having viewed the positive (T2P) or negative (T2N) film reels.

For T2P responses, Stage 1 analysis induced 12 clusters comprising 29 latent concepts (hits range 6 to 86; Figure 3). In Stage 2, clusters were interpreted to represent (from most to least prevalent): improving human lives, designed applications, task performance, taking

FIGURE 3 Semantic Network Map for the *T2* Responses to Robot Mental Model Elicitations Following Viewing of a "Good Robot" Film Reel



on workload, human-machine interdependence, taking human jobs, helpfulness, variation in robots and situations, social roles, need for purpose, helpfulness in everyday labor, and relatedness to technology in general. See Table 2.

TABLE 2 ***T2* Themes in Participant Characterizations of Robots Following Viewing of a "Good Robot" Film Reel**

Theme Label	Concepts	Hits	Description	Example Data Extract
Improving Lives	Tasks, life, provide†	86	Performing specific tasks and services (by design) improve human life.	… help aid *human* beings in *tasks* that are demanding … should be used to help *human* beings *live* a better and easier *life* … *provide* care through speech and action to *human* beings.
Designed Applications	Programmed, used, machines	50	Machines created for specific purposes (where purposes were both humanizing and dehumanizing).	… *machines* that are created for a purpose … *used* in the production of parts. Robots can do anything they are *programmed* to do …
Performance	Perform, example	32	Execution of specific tasks (paired with illustrations).	… can *perform* any task as long as it has the right code … for *example,* Alexa can now control the thermostat …
Taking Work	Take	15	Assumption of some work, whether helpful or harmful for humans.	… *take* the load off of our shoulders …
Intelligence	Intelligence	14	(Not) having kinds or degrees of intelligence.	… can be extremely helpful and *intelligent* creations …
(Inter) dependence	Need	14	Things that humans (do not) need from robots or robots from humans.	… machines that do not *need* human control to function …
Taking Jobs	Jobs	12	Possibility or likelihood that robots will take human jobs (for good or ill).	…. machines can do a better *job* than humans because of their increased efficiency ….
Helpful	Helpful	12	Applications, scenarios, or contexts in which robots would be helpful to humans.	… they could be *helpful* inside the household …
Variation	Different	10	Variability in what robots are, what they can do, and how they are distinct from other machines.	… designed with many *different* responses to the original input …
Social Roles*	Play	10	Robots' general role in society, usually linked to making human life easier.	… should *play* supporting roles in human lives …

Theme Label	Concepts	Hits	Description	Example Data Extract
Purposiveness	Purpose	7	Prescriptions that robots must serve purposes defined by humans (versus self-determined).	… I do not believe there should ever be freely roaming around without a *purpose* …
Mundane Labor	Daily	6	Appropriateness of robots helping with the mundane tasks of daily life.	…. perform *daily* tasks at home such as cleaning …
State of Technology	Technology	6	States of technology (broadly) in relation to robot functions of abilities.	… capability varies widely because the access to *technology* varies …
Note: †"human" was also a heavily weighted predictor, though not a formally identified concept. *Theme is interpreted to be an unexpected artifact of the elicitation that could not be avoided through term exclusion; it is removed from further analysis.				

For T2N responses, Stage 1 analysis induced 11 clusters comprising 27 latent concepts (hits range 6 to 85 instances, Figure 4). In Stage 2, clusters were interpreted to represent (from most to least prevalent): improving human lives, designed task performance, designed utility, social roles, status as a technology with specific functions, efficiency benefits, need to accommodate (not disadvantage) humans, appropriateness of providing services, taking risky jobs, existing with a human-defined purpose, and home as a context for labor. See Table 3 on the following page.

FIGURE 4 Semantic Network Map for the *T2* Responses to Robot Mental Model Elicitations Following Viewing of a "Bad Robot" Film Reel

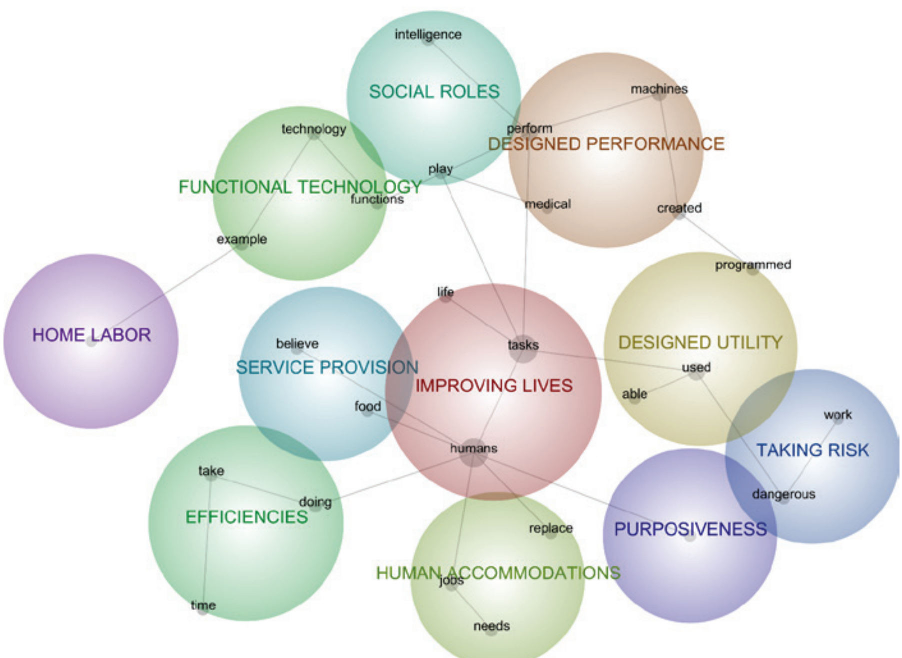
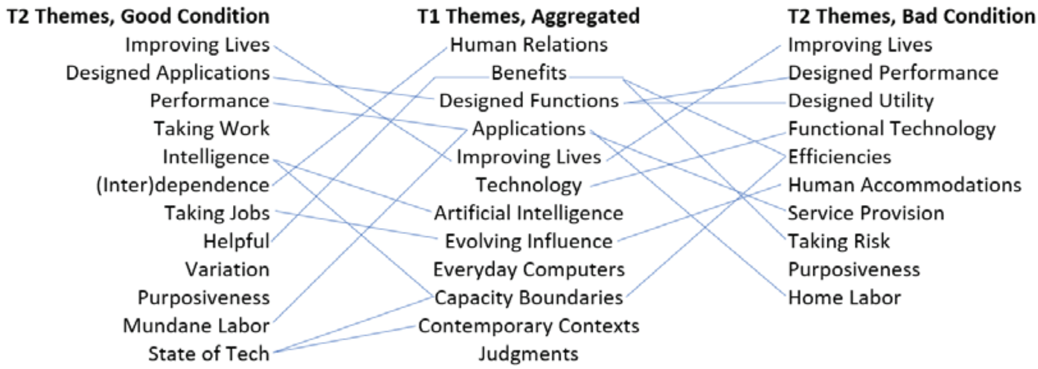


TABLE 3 *T2* Themes in Participant Characterizations of Robots Following Viewing of a "Bad Robot" Film Reel

Theme Label	Concepts	Hits	Description	Example Data Extract
Improving Lives	Humans, tasks, life	85	Performing specific tasks and services (by design) improve human life.	… complete hyper specific *tasks* and problems. Robots should be created and employed to better *human life* …
Designed Performance	Perform, machines, created, medical	45	Performing functions (general or specific) designed by humans.	… *machines* that are *created* to *perform* human activities or tasks …
Designed Utility	Used, programmed, able	44	Used by humans according to the technology's designed abilities.	… *used* to perform routine tasks … the computer *programming* behind them is really the limitation …
Social Roles*	Intelligence, play	26	Robots' general role in society as a function of its intelligence (or that of its creators).	… artificial *intelligence* made for a purpose … can *play* many roles in society.
Functional Technology	Example, technology, functions	26	Technology with particular functions (paired with illustrations).	… piece of *technology* that is very advanced that can perform different *functions* …
Efficiencies	Take, doing, time	25	Improvement in efficiencies through reduced time for tasks.	… should increase efficiency and decrease the *time* certain tasks may *take* …
Human Accommodations	Jobs, replace, needs	25	Prescriptive imperative for robots to fulfill human needs, and not draw (job) resources.	… should … understand the common basic things a person may *need* then if worse comes to worse will start to *replace* people's *jobs* …
Service Provision	Believe, food	19	Belief in the appropriateness of service roles (especially food delivery).	… take *food* orders, deliver food, vacuum, clean house, and … I *believe* they can take the place of some of things that humans do …
Taking Risk	Work, dangerous	13	Taking up dangerous roles to avoid risk to humans.	… do *work* in *dangerous* environments so humans don't have to …
Purposiveness	Exist	10	Existence defined by purpose as ascribed by humans.	… something mechanical that *exists* to aid humans …
Home Labor	House	6	The home as a context for labor.	… make coffee, clean *house*, and do what they are told …

Note: *Theme is interpreted to be an unexpected artifact of the elicitation that could not be avoided through term exclusion; although it appears to focus on intelligence as a concept, most source data is focused more squarely on social roles. In parallel with the T2P decision, it is removed from further analysis.

FIGURE 5 Themes and Theme-Relations for *T1* Robot Characterization, Compared to T2 Positive Condition and T2 Negative Condition Characterizations



Note: Theme labels are drawn from Tables 2–4. Lines indicate interpreted topical similarities in themes between *T1* aggregate themes (center) and T2 condition-specific themes (left and right).

Comparison of Higher-Order Themes

To completely address RQ1, we compare themes derived from *T1* to themes derived from each of T2P and T2N. Topical associations in this comparison are illustrated in Figure 5. Importantly, these are qualitative comparisons made based on themes derived from group-level data, so interpretations and derivative claims pertain only to general patterns across groups (and not about any individual's discrete mental model). As similarities and differences are multiple and nuanced, we separately discuss the observed changes between *T1/T2*, additions and losses of content between *T1/T2*, and comparisons following positive/negative contact.

Post-Stimulus Shifts in Topic Specificity, Prevalence. For *T1/T2*, most notable is the shift from the prevalence of higher-order concepts to more specific concepts. *T1* themes attend to human-robot (non-)relations, robot benefits, robot applications, and robot influence—in a more general sense—while *T2* themes included related but more specific discussions of human-robot interdependence mechanisms, specific benefits like helpfulness and efficiency, specific applications like home labor, and the influences of job displacement. The more general notion of robots being bounded in their capacities (i.e., having potentials and/or limitations in abilities) shifted toward discussions of specific capacities (i.e., intelligence and efficiencies). Moreover, when people discussed these more specific capacities, those themes were more prevalent in discussions (i.e., higher on the theme list). Similarly, ideas about improving human life (whether actual, potential, or prescribed) were of middling prevalence at *T1* but rose to be *most* prevalent at *T2* such that the content remained similar but the discursive weight within the data sets increased after the stimulus film. Finally, although themes of robots as designed (i.e., made by humans) can be seen across both *T1/T2*, at *T1* the consideration is of their designed *function* (that is, what can they do mechanistically) whereas at *T2* the discussions focused more on applications and utility (how humans design them for practical use) and performance (how they are effective according to human design). In other words, in discussing robots there may be a shift from general functioning-by-design to *human-centered* functioning-by-design. Recalling that at both *T1* and *T2* participants were asked to think about robots as they exist *in general*, these shifts are altogether interpreted to suggest that parasocial contact with robots may motivate people to think about robots in ways that are more concrete, where particulars (rather than generalities) may become more salient, and these particulars are considered in relation to human experience.

Post-Stimulus Additions and Losses. Following exposure to the positive stimulus, a theme labeled "taking work" emerged as a multi-valenced consideration of how robots could offload human burdens, distinct from job displacement. Mentions of varied potentials for robots also followed the positive stimulus, highlighting ways that robots serve different purposes, behave in different ways, and perform in different ways. Thus, we did observe some additivity of positive concepts following positive representations—that is, that robots can benefit humans by displacing work (not necessarily jobs) and are not a homogenous category. For *both* conditions we interpreted the emergence of a theme representing purposiveness—that is, prescription that robots should or must exist according to a mandate ascribed by humans. It could be that depictions of human-robot interactions (whether positive or negative) initiate a kind of reactance by which people are compelled to reinforce anthropocentric constraints around robot existence. There are no other additions for the negative stimulus.

Two themes from *T1* did not appear in concept maps at *T2*—or at least ceased to be cohesive themes amid other ideas. The *T1* theme representing robots as everyday computers like smartphones and Alexa—already functioning in human society—fell away at *T2* and mentions of those technologies instead were exemplars for other themes. Additionally, personal judgments about robots (anchored to the word *feel*) fell away, suggesting a decreased weight of *feel* or *feelings* in how people discussed robots following the films.

Comparison of Experimental Groups. Both experimental groups' interpreted themes include robots as improvers of human lives (generally or through specific benefits), having a *designed* status and functioning according to that design, having specific applications and utilities, subject to protection of human interests (taking jobs, human accommodations) and ascribed purposes, mundane labor (in general, or in the home). Thus, there appears to be a substantial amount of MM content that is not a function of parasocial contact valence (though perhaps content activated by seeing any kind of robot media depiction, as discussed above).

However, there are indications that some MM content is new or made salient as a function of contact valence. Responses from the positive contact condition emphasized robots taking on burdens, human-robot interdependence (what each needs from the other), helpfulness (as a self-relevant benefit, versus more general efficiencies), recognition of variation among robots, and more general discussion of intelligence (not necessarily artificial). This set of distinguishing themes is interpreted to suggest that those experiencing positive parasocial contact are perhaps more likely to have salient *social* content in robot mental models (that is, considerations of relatedness, traits, difference, and agency), in addition to content around their functionality. In contrast, responses from the negative contact condition emphasized robots' status as a technology, efficiencies (as a practical matter), requisite accommodation of and service to humans, and taking bodily risk in humans' stead. These distinct themes suggest that negative parasocial contact may promote anthropocentric orientations, maximizing ontological differences and prescribed human primacy.

Pre-/Post-Stimulus Attitude Changes (H1–2, RQ2)

With quantitative measures being only moderately intercorrelated (Table 4), separate *t*-tests were conducted for desired physical, relational, and conversational distance, as well as for perceived warmth and competence. Specifically, we used change scores (subtracting *T1* from *T2* values) as dependent variables in these tests—which allows for a more intuitive interpretation while producing the same results as a repeated-measures ANOVA.

As can be seen in Table 5 on the following page, only one of the five conducted *t*-tests revealed a significant group difference for the change between *T1* and *T2*. Specifically, we found that the parasocial contact conditions evoked a different decrease in desired conversational distance, $t(68) = 2.02$, $p = .047$, Cohen's $d = 0.48$: Viewing the negative reel led to a notably smaller reduction of this variable ($M = -0.43$, $SD = 1.46$) than viewing the positive reel ($M = -1.23$, $SD = 1.83$). In other words, positive parasocial contact more greatly reduced tendencies to be conversationally close to robots (i.e., they would be more intimately disclosing through conversation). There were no significant group differences for stereotype content or for other social distance operationalizations. Findings were robust to age, gender, prior exposure, media character familiarity, and manipulation check covariates (see online supplements). As such, H1c was supported by our data, whereas H1a and H1b are rejected.

TABLE 4 Zero-Order Correlations of the Study Variables

	Variable	1	2	3	4	5	6	7
1	Age	–						
2	Gender[1]	.13	–					
3	Difference in perceived warmth (*t2 – t1*)	.08	–.13	–				
4	Difference in perceived competence (*t2 – t1*)	–.03	–.04	$.54^{***}$	–			
5	Difference in desired physical distance (*t2 – t1*)	.08	–.06	–.02	–.01	–		
6	Difference in desired relational distance (*t2 – t1*)	–.04	.11	$-.36^{**}$	–.23	–.03	–	
7	Difference in desired conversational distance (*t2 – t1*)	–.03	$.30^{*}$	$-.32^{*}$	–.17	–.12	$.44^{***}$	–

Note: * $p < .05$, ** $p < .01$. [1]Gender coded with "0" = female, "1" = male, *** $p < .001$.

Table 5 Descriptive and Inferential Statistics Regarding the Examined Group Differences

	Positive parasocial contact		Negative parasocial contact		*t*-test statistics	
	M	*SD*	*M*	*SD*	*t*	*p*
Stereotypes	$n = 35$		$n = 36$			
Difference in perceived warmth ($T2 - T1$)	+1.85	1.45	+1.81	1.34	0.13	.894
Difference in perceived competence ($T2 - T1$)	+0.76	1.22	+0.66	1.55	0.31	.754
Social Distance	$n = 35$		$n = 35$			
Difference in desired physical distance ($T2 - T1$)	−0.20	0.78	−0.54	1.27	1.35	.180
Difference in desired relational distance ($T2 - T1$)	−0.63	1.40	−0.54	1.22	0.27	.785
Difference in desired conversational distance ($T2 - T1$)	−1.23	1.83	−0.43	1.46	2.02	.047

Note: Participants could answer all items voluntarily. This resulted in different final sample sizes for the measures, which are stated accordingly.

Discussion

Recognizing the importance of media exposures in the face of limited experiences with actual social robots, the present study identified a notable effect of positive (versus negative) parasocial contact, as it decreased the desired conversational distance from robots. In tandem, we observed that—although much mental model content about robots persisted through the film exposure—parasocial contact *may* influence mental models for robots as an ostensible outgroup, even after a single, 10-minute treatment. Specifically, it appears that parasocial contact promoted salience of more specific, concrete, and human-centered concepts, where positive contact results in attention to more social considerations and negative contact maximizes ontological differences. We interpret these findings to suggest that valenced parasocial contact with robots likely offers limited-yet-meaningful influences on people's knowledge of and attitudes toward actual robots.

In comparing pre- and post-stimulus concept maps that represented aggregate mental models, we see a good deal of qualitatively similar content—including post-stimulus content similarity between those viewing positive and negative stimuli. We interpret these patterns to suggest that mental models largely persist through parasocial contact valence; nevertheless, the latter *does* seem to introduce small but meaningful changes. Perhaps most important to PCH theory, positive exposure appeared to make salient notions of sociality and positive traits as well as individual differences within the outgroup, while negative exposure highlighted utility and tool-status. This echoes PCH-related findings from the human-to-human context: In interpersonal settings, outgroup members are often dehumanized (i.e., being denied fundamental human traits such as warmth and civility, as well as their individuality; Harris & Fiske, 2006; Haslam, 2006), but positive contact may reduce this bias (Bruneau et al., 2020). As such, we want to stress the additive effects of positive MM content as a particularly noteworthy result of our PCH-guided investigation: Depicting robots as benevolent and non-stereotypical led participants toward a more individualized and social perception of this outgroup.

At the same time, even positive robot portrayals may underscore that they are not human to begin with—which perhaps explains why both experimental groups were nonetheless anthropocentric in orientation. Concept maps for *both* parasocial conditions suggest an increased and more specific inclination to mention the human-made nature of social robots in their mental models at the second measurement point. Even those with positive contact focused on human benefit and those with negative contact attended to topics that maximized ontological differences. We interpret this finding to indicate potential psychological reactance: Faced with elaborate and human-like depictions of robots (regardless of their tonality), participants may have experienced discomfort with the non-familiarity of dramatic human-robot interactions or, more intensely, with a symbolic threat to their human distinctiveness (e.g., Stein et al., 2019). In response to this supposedly unpleasant impression, it could be that notions of human superiority (i.e., people as the *makers* of robots) were invoked as an implicit reclamation of control. In a sense, this interpretation suggests that parasocial contact with robots may also prompt a different kind of reactive dehumanization—one that emphasizes human control through making, using, and assigning purpose.

In the second part of our statistical investigation, we observed that people having negative and positive parasocial contact *both* showed a decrease in desired conversational difference. That is, both groups were more willing to communicate more intimately with the robot after an actual exposure compared to before (likely as a matter of mere exposure under controlled conditions; Haggadone et al., 2021). Importantly, though, those with positive parasocial contact exhibited a much more dramatic reduction in desired conversational distance—very much in line with PCH tenets (Banas et al., 2020). We believe that this finding holds particular relevance for the field of human-machine communication (HMC), which is invested in understanding the dynamics by which humans and machines make meaning together (Guzman, 2018). By increasing people's willingness to approach and share information with robots, media depictions may be a key driver in social closeness or distance that people feel toward robots as a group and as individual social actors. Specifically, this study offers initial evidence that media impressions help to shape more positively and negatively valenced mental models, and so may qualitatively shape people's willingness to engage humanoid robots as an ostensible outgroup.

In summary, by looking at our core results—positive additions to MM content (sociality, individual difference) and decreased conversational difference among those with positive parasocial contact—we conclude that media representing positive robot qualities (and associated positive HRI) could serve as a bridge toward more open communication among humans and machines. More broadly, our work points to the utility of PCH as a promising framework for understanding meaning-making around social robots. Guided by this comprehensive theoretical approach, we not only observed meaningful changes in participants' mental models, but also obtained a significant finding in an underpowered statistical investigation (such that other stereotype content and social distance outcomes could be relevant for a larger sample). Therefore, we invite our peers to follow up on our theoretical groundwork, as HMC studies involving parasocial contact theory might indeed go beyond traditional cultivation or habituation approaches.

Limitations and Future Directions

Several limitations must be considered in this work. We engaged a single set of film stimuli with a narrow selection of (exclusively anthropomorphic) robots, considered by a somewhat narrow sample (i.e., skewing younger in a socially and politically conservative community). Mental model and social judgment effects could vary with differing media and robot stimuli, especially around different machine morphologies—although we suppose that our film stimuli afforded reasonable breadth by integrating multiple dimensions of positive and negative outgroup contact. As such, future work could consider other mass-mediated robot depictions more broadly (e.g., of zoomorphic or fully abstract robots, dramatic situations, and interaction contexts such as dyads versus groups) and more narrowly (e.g., only looking at different robot facial expressions). Additionally, the induction of clusters from qualitative data was completed using a single tool with particular settings and results were interpreted by a single analyst; thus, it is possible that other inquiries using different analytical parameters could identify different outcomes. Thus, as with most exploratory work, this work should be replicated and extended to advance the validity of our claims.

Since our analysis of mental models uncovered that the human-centered attribution of roles to robots seems to be of high importance, future research that applies the PCH to social robots is also encouraged to focus more on different role representations in the media (e.g., a tool, a helper, a guardian) as antecedents of changing perceptions and attitudes. While such efforts could start with replicating our multi-method approach, we suggest that additional measures may be useful. Among the many options in this regard, studies could shift their focus from subjective assessments to more concrete (behavioral observation) or implicit (e.g., IAT) measurements. In the same vein, longitudinal research could help to shed light on the stability of the evoked changes, and to ultimately create a scientific perspective that truly acknowledges quality *and* quantity to a comparable extent.

Conclusion

Fictional media make more or less salient the possible risks and benefits of a world populated by social robots—from lives of increased comfort to impending doom. Research previously examined such effects in terms of exposure quantity, yet the present research draws on parasocial contact theory to augment the record with evidence that exposure *quality* may also play a role by making salient beneficial outcomes from interactions with diverse robots. Through a more comprehensive quantity-and-quality approach afforded by PCH, we may better understand how media help to shape perceptions of sociality and interdependence regarding robots as an outgroup—toward prosocial and antisocial ends.

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Author Notes

The authors have no conflicts of interest to disclose. First authorship is shared between both authors.

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