

Negotiating Through the Night: How Sleep Deprivation Can Affect Negotiation Processes and Outcomes

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Abstract

Sleep deprivation is highly prevalent in negotiations, but little is known about how sleep deprivation may affect negotiation processes and outcomes. We present a theoretical framework for understanding and investigating effects of sleep deprivation on a range of negotiation outcomes, particularly joint economic outcomes, individual economic outcomes, social perceptions, and impasses. With an emphasis on integrative negotiations, we identified cognitive capacities and epistemic motivation as highly relevant psychological processes negatively affected by sleep deprivation, as these impairments hamper effective information exchange and downregulate or bias information processing in negotiations. This, in turn, reduces the quality of (integrative) agreements. Regarding impasses, our model predicts that impaired cognitive capacities and sleep deprivation-induced negative emotions (e.g., anger) could increase the likelihood of non-agreements. Moreover, sleep deprivation-induced negative emotions should have a negative effect on social perceptions. Finally, we discuss potential moderators on the task, the individual, and the inter-individual level and show how sleep deprivation-induced impairments can be compensated for. In sum, our analysis advances the understanding of how and when sleep deprivation might have an effect on negotiation outcomes.

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Many high-stakes negotiations in the political world and in business are conducted under severe sleep deprivation. Think, for example, of negotiations at international summits (e.g., the Conference of the Parties [COP26] in Glasgow negotiating climate-related measures in 2021 or the Greek debt negotiations in 2015) or forming a government (e.g., after the federal elections 2013 and 2017 in Germany). In such negotiations, sleep deprivation is very likely to occur, because these negotiations often a) span several days with long working hours, b) extend deep into the night, c) are scheduled at short notice due to urgency, and d) are affected by jet lag in the case of international negotiations. Table 1 provides some examples of high-stake negotiations conducted under sleep deprivation.

But what are the consequences of lack of sleep on negotiation outcomes? Surprisingly, although the effect of sleep loss in negotiations is highly relevant from an applied perspective (and also from a theoretical perspective as we will show in this article), we are aware of only one empirical manuscript and no theoretical accounts on this topic. Although negative outcomes may intuitively be expected, it is still unclear whether and to what degree, as well as through which mechanisms, sleep deprivation may affect negotiation outcomes. If severe negative effects invariably unfold, negotiating under sleep loss should not be seen as a viable option due to its general ineffectiveness. However, the prevalence of sleep deprivation in high-stakes negotiations emphasizes the need to understand the potential mechanism and moderators of the relationship between sleep deprivation and negotiation outcomes. The first pertinent manuscript (Halfmann et al., 2022) showed in several studies that sleep deprivation does not necessarily result in worse negotiation outcomes, but could be compensated for by different measures. These measures are located at different levels (e.g., individual or inter-individual level). We will discuss potential moderation and compensation in this paper.

The key objective of this paper is to present a framework for understanding and investigating the potential effects of sleep loss in negotiations. In view of the vast lack of empirical studies directly testing such effects, we review previous empirical findings on the psychological effects of sleep deprivation that can play a role in negotiations. We built our framework on an analysis of specific psychological and cognitive processes that are, on the one hand, highly prone to being affected by sleep deprivation and, on the other hand, shape negotiation outcomes. Technically speaking, such processes are potential mediating mechanisms linking sleep deprivation to negotiation outcomes. Specifically, in our analysis, we will focus on the joint economic outcomes in bilateral negotiations and show that *cognitive capacities* and *epistemic motivation* (i.e., the motivation to exert cognitive effort to obtain an accurate understanding of things) are likely to play a crucial role for this negotiation outcome when negotiating under sleep deprivation. These mediation paths point to a general prediction of why sleep deprivation should negatively affect joint economic outcomes. In addition to joint economic outcomes, we will address a range of negotiation outcomes potentially affected by sleep deprivation, including individual economic outcomes, socio-emotional outcomes, and impasses (i.e., non-agreements). Here we will also discuss sleep-deprivation-induced emotions as a process linking sleep deprivation to socio-emotional outcomes and impasses. Furthermore, we will discuss reasons for why no uniform negative effects on joint economic outcomes should be expected and we focus here on potential compensatory mechanisms. When doing so, we will present conditions on the task, the individual, and the inter-individual level under which the negative effects should be less likely to occur.

Table 1

Examples of Prolonged and Late-Night Negotiations

Year	Negotiation topic	Negotiating parties	Location
1991	Maastricht Treaty	European Communities	Maastricht; Netherlands
1997	French truck driver strike	Union & employer's group	Paris; France
2000	COP6-Climate Change Conference	United Nations	the Hague, Netherlands
2008	Wall street bailout	U.S. Congress	Washington, D.C.; U.S.A.
2012	Arms Trade Treaty	United Nations	New York; U.S.A.
2013	German coalition negotiation	German political parties CDU/CSU & SPD	Berlin; Germany
2015	Greek government debt bailout	Eurozone head of states	Brussels; Belgium
2015	Iran Nuclear Deal Framework	Iran Foreign Minister, P5+1, EU	Lausanne; Switzerland
2015	Minsk II – war in Ukraine	Heads of state of Ukraine, Russia, & OSCE	Minsk; Belarus
2015	COP21-Climate Change Conference	United Nations	Paris; France
2017	German coalition negotiation	German political parties SPD, FDP, & Green Party	Berlin; Germany
2019	Party merge and change of leadership	Union of right wing parties in Israel	Tel Aviv; Israel
2019	Collective bargaining	Union & B.C. Maritime Employers Assoc.	Vancouver; Canada
2019	Brexit negotiations	U.K. & EU	Brussels; Belgium
2019	Execution of death row inmate	U.S. Supreme Court	Washington, D.C.; U.S.A.
2019	U.S. federal government shutdown	U.S. Congress & President Trump	Washington, D.C.; U.S.A.
2019	COP25-Climate Change Conference	United Nations	Madrid, Spain
2020	Collective bargaining	Vida trade union & Laudamotion airline	Vienna; Austria
2020	COVID-19 Pandemic Crisis Support	EU finance ministers	virtual
2020	Reform of Agricultural Policy	EU Ministers of Agriculture	Luxembourg
2021	COP26-Climate Change Conference	United Nations	Glasgow; U.K.
2021	COVID-19 Lockdown	German Federal Minister-presidents	Berlin; Germany
2022	Collective bargaining after strike	Transport unions & Jammu/Kashmir admin.	Jammu; India
2022	Fossil fuels car ban	EU environmental ministers	Luxembourg
2022	12th WTO Ministerial Conference	Members of WTO	Geneva; Switzerland

Note. List of illustrative examples of late- or all-night negotiations (sometimes over several days) that may have resulted in acute and chronic sleep deprivation among negotiators.

Our paper integrates research on sleep deprivation with research on negotiations. To the best of our knowledge, our analysis is the first to theoretically examine how sleep deprivation can affect negotiations. Although earlier theoretical accounts targeting the impacts of sleep deprivation on human functioning also emphasize the ‘social side’ of sleep, these earlier accounts are a broader collection of potentially relevant social contexts (Gordon et al., 2017), or specific to the contexts of group performance (Faber et al., 2017) or group decision making (Barnes & Hollenbeck, 2009). Hence, they do not account for relevant processes in inter-personal negotiations and do not allow specific predictions to be derived on this type of social interaction. Our theoretical model contributes to the literature in both fields, sleep research and negotiation research. Regarding sleep deprivation research, it provides new insights into the yet under-examined social

effects of sleep in organizations (cf. Christian & Ellis, 2011; Faber et al., 2017). Regarding negotiation research, with the introduction of sleep deprivation, we contribute to the literature by spotlighting a—yet neglected—prevalent and potentially powerful context factor.

Sleep Deprivation

Insufficient sleep is highly prevalent in modern societies, and has therefore been dubbed a public epidemic by the U.S. Centers for Disease Control and Prevention (2015). Sleep deprivation refers to a state of insufficient sleep, either acute (also termed *total sleep deprivation*), in which individuals are usually awake for more than 24 hours, or chronic, which means less-than-normal sleep for several consecutive nights. Generally, the psychological effects of acute and chronic sleep deprivation are similar (Banks & Dinges, 2007). In our analysis, we therefore refrain from distinguishing between both forms of sleep deprivation. Sleep deprivation has been found to have impairing effects on human functioning, on the individual level (i.e., the cognitive level; for a review, see Alhola & Polo-Kantola, 2007) as well as on the inter-individual level (i.e., the social level; for a review, see Gordon et al., 2017)—clearly, impairments on both levels are highly relevant for negotiations.

Negotiations

Negotiations are interactions between at least two parties in which the common goal is to achieve an agreement concerning a (perceived) conflict of interest (e.g., Pruitt & Carnevale, 1993). A negotiation is therefore characterized as a mixed-motive situation because, on the one hand, each party is motivated to act competitively to realize own interests ("claiming value"), while on the other hand, there are also incentives to be cooperative and realize not only the own, but also the other party's interests to accomplish the mutual task of coming to an agreement ("creating value"; Hüffmeier et al., 2019). A useful and commonly accepted distinction has been made between distributive and integrative negotiations (Walton & McKersie, 1965). Whereas distributive negotiations are zero-sum situations (i.e., any gain for one party corresponds to an equivalent loss for the other party), in integrative negotiations, joint outcomes can, for instance, be increased by mutual concessions building on different priority structures (i.e., between-issue valuation) and/or identical preference structures (i.e., within-issue valuation) of the negotiation partners. Integrative solutions can only emerge if a negotiation provides possibilities to expand the total amount of dividable resources, benefiting all negotiation parties (e.g., Thompson & Hastie, 1990).

Joint Outcomes in Integrative Negotiations

Most negotiations contain at least some degree of integrative potential (Raiffa, 1982; Thompson & Hastie, 1990). In such negotiations, the joint economic outcomes, that is, the mutual pay-off the negotiation partners receive based on the achieved agreement, are an important indicator of the success of a negotiation. Joint outcomes are the crucial measure of how integrative or mutually advantageous, in other words, objectively good, an agreement is. As the interests of both parties are at least partly compatible in integrative negotiations, it is possible to create additional value if the *integrative potential* is unlocked via recognizing the (partial) compatibility of the parties' interests and then using this knowledge. Making use of a negotiation's integrative potential to increase joint outcomes requires the exchange and processing of information, which can occur via three different approaches.

First, by using a heuristic trial-and-error approach, negotiators can draw inferences regarding the interests of the negotiation partner from an unsystematic exchange of offers and reactions to these offers (Pruitt & Lewis, 1975; Yao et al., 2021). These inferences can help to uncover the negotiation's integrative

potential even without a direct and trustful information exchange about the parties' interests. For example, if a negotiation partner is highly reluctant to concede on a specific issue, the other negotiation partner could infer that this specific issue is of high priority for the negotiation partner.

Second, the integrative potential can also be tapped by using multi-issue offers, which can range from two to all negotiation issues (Weingart et al., 1999; Yao et al., 2021). When negotiators make a series of multi-issue offers and receive answers to these offers from their counterparts, all parties can glean information on the respective interests (Pruitt, 1981; Yao et al., 2021). For example, one could infer that negotiators have different priorities towards certain issues if they are willing to concede on one, but not on another issue in such a package offer.

The two aforementioned approaches can be effective in gaining valuable insights into the partner's priorities and preferences. However, in addition to information exchange, these approaches require systematic information processing and a valid interpretation to identify underlying priorities and preferences. As a third approach, negotiation parties can also engage in *interest-related information exchange* by directly providing interest-related information and by asking interest-related questions to unlock the integrative potential (Bazerman & Neale, 1982; Pruitt & Lewis, 1975; Thompson, 1991). For example, a negotiator could tell the other negotiator that a specific issue in the negotiation is more important to them than another issue.

All three approaches illustrate that the processing and exchange of information is crucial to understand and unlock the integrative potential of a negotiation and therefore is the key for optimizing joint outcomes (Fairfield & Allred, 2007; Thompson, 1991; Zerres et al., 2013). Any type of information exchange increases the likelihood to detect a negotiation's integrative potential, but the exchange of interest-related information most directly enables negotiators to understand the underlying priorities and preferences of the negotiation partner, as it explicitly provides relevant information. A correct understanding of the underlying priorities and preferences in turn can be used for *log-rolling*, that is, a systematic trade-off of low- and high-value issues (Froman & Cohen, 1970) and for exploiting compatible preferences (Thompson & Hrebec, 1996), thereby increasing the joint economic outcomes.

Effects of Sleep Deprivation on Joint Economic Outcomes

Negotiations are complex and multi-faceted social interactions with a multitude of relevant outcomes (e.g., Cai et al., 2000; Curhan et al., 2006; De Dreu & Carnevale, 2003; Thompson, 1990). In this article, we put an emphasis on the joint economic outcomes of negotiation partners in integrative negotiations. In such negotiations, processing large amounts of inter-related information is the key to arriving at optimal joint economic outcomes. A useful theoretical lens to understand the depth of information exchange and information processing in negotiations is dual-process models (e.g., Petty & Wegener, 1999). According to such dual-process models, individuals, or in our case negotiators, operate in two distinct *modi operandi* regarding information processing: Automatic and fast processing, using heuristics and routines (System-1 processing) versus slow and deliberative processing, using systematic and more complex approaches (System-2 processing). System-2 processing is cognitively effortful and presupposes a motivation for deep processing (Stanovich et al., 2014). Thus, if negotiators lack sufficient skills (cognitive capacities) and sufficient will (motivation) required for System-2 processing in a certain situation, they will not engage in systematic processing of interest-related information, or will fail to induce this type of information from the unsystematic exchanges of offers and counteroffers or multi-issue offers.

Based on theory and research on cognitive and motivational impairments due to sleep deprivation and as explained in detail below, we predict that sleep deprivation should be negatively related to information exchange and effective information processing in negotiations. We argue that this, in turn,

should impair joint economic outcomes in integrative negotiations (see the *Propositions* 1.1 and 1.2 below and Figure 1).¹ Thus, we put forward the following general proposition:

Proposition 1. Sleep deprivation should reduce joint economic outcomes in integrative negotiations.

In the following, we will provide theoretical arguments and empirical findings that back up and specify this proposition. In particular, taking the dual-process perspective, we identified impaired *cognitive capacities* and reduced *epistemic motivation* as crucial psychological pathways linking sleep deprivation to negotiation outcomes (see Figure 1). Each of these two broad pathways comprise different specific mediation mechanisms, which we will outline in detail below.

Effects of Sleep Deprivation on Cognitive Capacities in Integrative Negotiations

We expect that acute sleep deprivation will impair cognitive capacities that are relevant for exchanging and processing information in integrative negotiations, which reduces the likelihood of (fully) integrative joint economic outcomes. Because negotiations are cognitively taxing tasks involving the processing of a large amount of information (e.g., data, documents, terms, schedules, verbal information, non-verbal information; Bazerman et al., 1999; De Dreu et al., 2006; Neale & Bazerman, 1991), they strongly claim cognitive processes such as working memory functions (Sharma et al., 2013).

By disrupting the executive functioning of the prefrontal cortex, acute sleep deprivation negatively affects various cognitive processes. Sleep deprivation, for instance, has a strong negative effect on vigilance and attention ($d = -0.76$, see Lim & Dinges, 2010, for a meta-analysis). These processes are, as Lim and Dinges (2008) argue, fundamentally important for all more complex forms of cognition. In particular, *working memory (WM)*, the "maintenance and manipulation of relevant information over a brief period" (Lim & Dinges, 2010; p. 381), is impaired. In a pertinent meta-analysis by Lim and Dinges (2010), aggregated moderate effects of $g = -0.56$ for WM accuracy and $g = -0.52$ for WM speed were reported, with a clear dose-effect relationship evident in increasing effect sizes with more hours awake (see also Philibert, 2005). The parietal cortex and other brain regions associated with verbal working memory show a decreased cortical response under sleep deprivation (Mu et al., 2005), suggesting that sleep-deprived individuals have less cognitive resources for paying attention to verbal cues.

Processing of verbal information is crucial in negotiations. Particularly, cues that are related to interest-related information are highly relevant for negotiations. Thus, the decreased cortical response represents an obvious obstacle to effective information processing. This notion is confirmed by a meta-analysis (Sharma et al., 2013), which found cognitive abilities ($r = 0.20$) to be significantly predictive of joint economic outcomes. Moreover, it has been argued that WM functioning should be positively related to better negotiation outcomes (e.g., Fulmer & Barry, 2004). Hence, when cognitive capacities are impaired due to sleep deprivation, negotiations may result in suboptimal agreements. This is because sleep-deprived negotiators would be less effective in exchanging information and in drawing valid inferences from this information, which impairs unlocking a negotiation's integrative potential.

In addition to attention and working memory, several other cognitive functions that are relevant for information processing in negotiations are impaired due to sleep deprivation. The ability to incorporate new

¹ In purely distributive negotiations (i.e., zero-sum negotiations), joint economic outcomes are fixed, and therefore, by definition, sleep deprivation (as with any other factor) cannot have an impact on joint outcomes in this type of negotiation. However, in such negotiations, sleep deprivation should still have an impact on individual economic outcomes and impasses via different processes as we will show below.

information into existing mental representations of a situation (*information updating*) is also impaired by sleep deprivation (Durmer & Dinges, 2005; Lim & Dinges, 2010; Killgore et al., 2006). Moreover, it has been found that the ability to abandon previously optimal and now suboptimal problem solving strategies (*cognitive flexibility*, see Luchins, 1942) as well as the ability to generate new ideas is lower for severely sleep-deprived compared to well-rested participants (Frings, 2011; Horne, 1988).

In negotiations, common misconceptions are assumptions of incompatible interests and the fixed-pie-perception (e.g., De Dreu & Carnevale, 2003; Thompson & Hastie, 1990). Negotiators with a fixed-pie-perception assume that negotiations are—in general—zero-sum situations, thereby possibly overlooking a negotiation's integrative potential and many negotiators enter a negotiation with this misperception (Thompson & Hastie, 1990). Cognitive inflexibility and increased persistence of mental representations due to sleep deprivation should prevent such dysfunctional assumptions from being revised. In other words, even if relevant new information is made available through information exchange in the course of a negotiation, sleep-deprived negotiators may not (fully) revise their initial assumptions. Thus, a more correct representation of the underlying conflict of interest would not result (i.e., the negotiation would still be perceived as fixed-sum even though it is variable-sum).

Finally, we further predict that sleep deprivation should impair perspective taking, and reduced perspective taking should limit the exchange and processing of (interest-related) information, thereby decreasing joint outcomes. Perspective taking (Davis, 1983) is defined as the cognitive process of considering the world from another person's viewpoint, which allows reasoning about beliefs, intentions, and thoughts of others as well as anticipating their behavior and reactions (Galinsky et al., 2008). Taking another person's perspective is a cognitively complex and effortful procedure (Epley & Caruso, 2008) and it is therefore likely to be affected by sleep deprivation. In line with this, research outside the negotiation domain provides tentative evidence for the idea that sleep deprivation impairs perspective taking, for example, in spatial perspective taking (Deliens et al., 2018) or sarcasm detection (Deliens et al., 2015).

With respect to negotiations, perspective taking has been argued to be an antecedent of the exchange and processing of interest-related information, because perspective taking is crucial to arrive at valid inferences regarding the other party's—potentially divergent—interests (e.g., Neale & Bazerman, 1983; Kemp & Smith, 1994). Supporting this theoretical notion, Trötschel et al. (2011) found that inducing a perspective-taking mindset in negotiations alleviates the risk of partial impasses and improves joint outcomes. These results are in line with Galinsky et al.'s (2008) findings that perspective taking helps to reach higher joint economic outcomes as compared to a focus on the own perspective.

With regard to cognitive capacities, we put forward the following proposition:

Proposition 1.1. The negative effect of sleep deprivation on joint economic outcomes should be partially mediated via impaired cognitive functions, which result in a less effective exchange and processing of information and a higher proneness to the fixed-pie-perception.

More specifically, we state that the most crucial impaired cognitive functions acting as concrete potential mediating mechanisms are a) working memory capacities, b) cognitive flexibility, c) information updating, and d) perspective taking.

Effects of Sleep Deprivation on Epistemic Motivation in Integrative Negotiations

In addition to cognitive impairments, *motivational effects* of sleep deprivation can also negatively influence information exchange and processing, thereby jeopardizing joint economic outcomes. We predict specifically that sleep deprivation should impair epistemic motivation. Epistemic motivation is the motivation to obtain an accurate and comprehensive understanding of an issue or a situation, and the willingness to

exert cognitive effort to achieve this goal (e.g., De Dreu et al., 2008; Kruglanski & Webster, 1996). Epistemic motivation is conceptualized as a state variable and is therefore susceptible to situational factors like fatigue (e.g., De Dreu, 2003; Webster et al., 1996). Generally, when sleep deprived, individuals show a reduced willingness to engage in cognitively demanding tasks and are less motivated to systematically process complex information (e.g., Odle-Dusseau et al., 2010; see Engle-Friedman, 2014, for a review). Although we are not aware of any direct empirical tests of the effects of sleep deprivation on epistemic motivation there is good reason to assume a negative impact. First, sleep deprivation has been found to curb motivation in general (Engle-Friedman, 2014). Second, for the specific case of epistemic motivation, it has been found that mental fatigue reduces epistemic motivation (Webster et al., 1996); and sleep deprivation is typically accompanied by mental fatigue (Durmer & Dinges, 2005).

Successful negotiations and especially fully integrative agreements require high levels of epistemic motivation (Brett & Thompson, 2016; De Dreu et al., 2008). Epistemic motivation contributes to joint outcomes in integrative negotiations, because negotiators have to be motivated to systematically exchange and process information that is relevant to priorities and preferences in a negotiation (for a related argument, see De Dreu et al., 2000, and Faber et al., 2017). In line with dual-process accounts, when epistemic motivation is low, however, information search is generally reduced and less systematic and the available information is processed more heuristically.

In line with this theoretical argument, negotiators with high epistemic motivation have been found to show a better understanding of the negotiation situation and the underlying conflict of interest, and they reached better joint outcomes (e.g., Ten Velden et al., 2010). Conversely, De Dreu et al. (1999) showed that low dispositional epistemic motivation leads to a heightened use of heuristics in negotiations.

In light of the eroding effects of sleep deprivation on the motivation to exchange and process complex information, we propose a negative effect of sleep deprivation on joint outcomes via reduced epistemic motivation:

Proposition 1.2. The negative effect of sleep deprivation on joint economic outcomes should be partially mediated via epistemic motivation: Sleep deprivation is negatively related to negotiators' epistemic motivation, which reduces the systematic exchange and processing of information, which in turn decreases joint economic outcomes.

Sleep Deprivation and Economic Outcomes in Distributive Negotiations

In integrative negotiations, joint economic outcomes can be considered as an objective benchmark for success. As, by definition, joint economic outcomes are the combined individual outcomes of the negotiation partners, psychological processes negatively affecting integrative solutions also reduce individual outcomes. In distributive negotiations, however, the joint outcomes are fixed (by definition), and therefore individual economic outcomes are of central interest. We argue that sleep deprivation further affects individual outcomes in such purely distributive contexts, due to increased heuristic processing, as a consequence of decreased cognitive capacities and epistemic motivation.

When lacking the skill and will for systematic information processing, people tend to operate in System-1 and rely more on automatic processing, routines and heuristics. In line with this, it has been found that sleep-deprived individuals use more heuristic information processing (Ghumman & Barnes, 2013; McKenna et al., 2007). Heuristic information processing can, in turn, play out in negotiations by biasing the evaluation of offers or requests. With respect to negotiations, heuristic processing in terms of anchoring is of particular interest (Galinsky & Mussweiler, 2001, Gunia et al., 2013). Anchoring is defined as the assimilation of a judgement to a relevant or arbitrary value (anchor) that is externally provided prior to judgement (Tversky & Kahneman, 1974). Anchors have been found to have strong effects on judgement and

decision making in diverse domains, such as probability estimates, legal judgements, purchasing decisions or forecasting (see Furnham & Boo, 2011, for an overview). In negotiations, first offers made by the negotiation partner can be powerful anchors. In three experiments, Galinsky and Mussweiler (2001) for instance found consistent evidence that first offers had an even stronger impact on final agreements than the subsequent concessions from both parties and that the negotiator who made the first offer obtained the better outcome (see also Moran & Ritov, 2002; Yukl, 1974, for related findings). This first-mover advantage is particularly pronounced in distributive negotiations, where the offer provides merely a numerical anchor without implying priority-related information (Loschelder et al., 2016).

As noted above, from a theoretical perspective, the role of anchoring in negotiations can be best understood through the lens of dual-process models (Kahneman, 2011). The presentation with an anchor (first offer) at least initially results in automatic processing of this anchor (System 1 - processing), using simple comparative strategies ("Is the offer too high?") and activation or generation of anchor-consistent knowledge ("How is this offer justified?"; Mussweiler & Strack, 2000). Moreover, it signals a range of plausible agreements and sets the stage for the final agreement (Galinsky & Mussweiler, 2001).

Hence, by increasing susceptibility to anchoring, sleep deprivation should have negative effects on individual economic outcomes for the receiver of the first offer. In contrast, for the provider of the first offer, sleep deprivation may even increase individual economic outcomes. Because sleep deprivation reduces inhibition and self-regulatory capacities (Welsh et al., 2014), sleep deprived negotiators might be bolder in setting their own anchors. This in turn can increase their final individual economic outcome, particularly if the negotiation partner shows increased proneness to anchoring due to sleep deprivation.

In sum, we argue that sleep deprivation should increase the susceptibility to anchoring, by impairing cognitive capacities and epistemic motivation. Thus, when negotiating under sleep deprivation, first offers are likely to have an even stronger impact compared to negotiating under well-rested conditions. Thus, we propose:

Proposition 2. Sleep deprivation should increase the proneness to anchoring, thereby increasing the first-mover advantage. Therefore, the negotiation partner making the first offer should realize higher individual economic outcomes, whereas the receiver of the first offer should realize lower individual economic outcomes.

Sleep Deprivation and Emotions in Negotiations

Beyond cognitive functioning and motivation, emotions may play a crucial role in negotiations under sleep deprivation. In fact, the effects of sleep deprivation on mood seem to be even more pronounced as compared to the effects of sleep deprivation on cognitive performance (see Pilcher & Huffcutt, 1996, for a meta-analysis). In negotiations under sleep deprivation the role of emotions should be two-fold with a need to differentiate between a) emotions as processes, and b) emotions as outcomes.

Emotions as Processes: Other-Related Emotions and Emotional Responsiveness

There is a plethora of studies showing negative effects of sleep deprivation on socio-emotional processing, with sleep deprivation altering the likelihood and intensity of negative emotions and reducing emotional responsiveness (see Ben Simon et al., 2020, for a recent review). Sleep deprivation is also associated with increased emotional instability and irritability (Minkel et al., 2012).

For negotiations, the inter-individual functions of emotions are of particular interest, because they most likely have an impact on interactions during the negotiation. In other words, emotion expression and

emotional responsiveness is altered as a consequence of sleep deprivation, which in turn affects the negotiation process and ultimately negotiation outcomes.

Particularly, sleeping poorly can induce feelings of anger (Short & Louca, 2015). In line with this, in an experimental study with a manipulation of sleep loss (restricted sleep over two days), Krizan and Hisler (2019) found that sleep loss can also intensify anger and prevent anger reduction over time. Moreover, sleep deprivation is related to reduced emotional intelligence, for example, expressed in reduced empathy for others (e.g., Killgore et al., 2008). Sleep-deprived individuals are less accurate at identifying emotions such as happiness or anger in other people's facial expressions (van der Helm et al., 2010). Sleep deprivation has also been found to influence emotional expressivity (i.e., fewer emotional words but a higher ratio of negative affective expressions are uttered, see Beattie et al., 2015, for a systematic review). In sum, as compared to well-rested individuals, sleep deprived individuals tend to show more negative other-related emotions, reduced accuracy in emotion perception and reduced emotional responsivity (cf. Ben-Simon et al., 2020).

In light of these findings, it seems likely that in negotiations under sleep deprivation negotiators would also be more likely to express negative other-related emotions, such as anger and would be less responsive to emotions expressed by the other party. Anger, accuracy of emotion perception, and responsiveness to emotions should affect socio-emotional outcomes of negotiations, that is, social perceptions of the negotiation and the negotiation partner (see below). Moreover, as we will show in the next section, negative other-related emotions should also increase the likelihood of impasses.

Emotions as Outcomes: Social Perceptions

In addition to 'hard' outcomes (i.e., the agreement detailing, for instance, the division of resources or mutual obligations), 'soft' outcomes of negotiations, such as social-emotional consequences, should also be taken into account (Curhan, et al., 2006; Thompson, 1990). In a seminal paper, Thompson (1990) argues that to arrive at a more holistic understanding of negotiations, the exclusive focus on objective economic outcomes is detrimental, because it tends to overlook relevant outcomes of negotiations—especially social perceptions. These social perceptions include the evaluation of and satisfaction with the negotiation process, the agreement, the negotiation partner, and the self (cf. Curhan et al., 2006).

Curhan et al. (2006) emphasize the importance of better accounting for the affective evaluations of the final agreement, and obviously, the mood and satisfaction of the negotiators are important outcomes in their own right. In addition, these *post-negotiation* social perceptions can foreshadow future negotiations, determining the economic outcomes of the negotiations to come (even when controlling for the economic outcomes of the first negotiation; Curhan et al., 2010). In line with this, aversive feelings regarding the interaction and the negotiation partner can reduce the willingness to cooperate in future negotiations (Kopelman et al., 2006). Reduced willingness to cooperate may jeopardize establishing effective long-term negotiation relationships, such as vendor-buyer relationships, political coalitions or romantic relationships.

We argue that social perceptions and feelings regarding *the process* and *the negotiation partner* are most likely to be influenced by sleep deprivation: Due to reduced emotion expression and impaired responsiveness the subjective interaction quality is likely to be less satisfying and the negotiation partner should appear less likable and sociable. Moreover, amplified anger in sleep-deprived negotiators should on the one hand negatively bias the own perception of the interaction and the negotiation partner (cf. *feelings-as-information theory*; Schwarz, 2010). On the other hand, hardline bargaining such as expressing anger when rejecting offers should also produce more negative social perceptions in the negotiation partner (Hüffmeier et al., 2014).

Taken together, with respect to emotions as processes and outcomes in negotiations, we state:

Proposition 3. Sleep deprivation should result in more negative social perceptions, that is, feelings and evaluations regarding the interaction and the negotiation partner. More specifically, this effect is mediated by sleep deprivation-induced a) anger, and b) reduced emotional responsiveness.

Sleep Deprivation and Impasses

We predict that sleep deprivation increases the risk of impasses through impaired cognitive flexibility and perspective taking as well as sleep deprivation-induced anger. Impasses emerge when the negotiating parties fail to reach a mutual agreement and, thus, the negotiation is terminated without the conflict of interest being solved (Tripp & Sondak, 1992). Knowledge about impasses is currently still limited (e.g., Cotter & Henley, 2017; Tuncel et al., 2016), but some factors have been discussed to help avoid impasses and deadlock negotiations. With respect to our model, it is interesting to note that the likelihood of impasses does not differ as a function of epistemic motivation (Ten Velden et al., 2010; van der Schalk et al., 2010). However, cognitive capacities may play a crucial role in whether or not an agreement is reached. In particular there are two relevant cognitive processes that have been found to contribute to the likelihood of impasses: cognitive flexibility in the bargaining process (Druckman & Mitchell 1995; Spector, 1995) and perspective taking (Galinsky et al., 2008; Trötschel et al., 2011). Cognitive inflexibility should lead to more rigid representations of the conflict of interests and reduced perspective taking should prevent the understanding of the negotiation partner's interests and therefore reduce the possibility of making mutually beneficial concessions. Because—as laid out earlier—cognitive flexibility and perspective taking are likely to be impaired by sleep deprivation, sleep deprivation should increase the danger of non-agreements.

Furthermore, it has been found that the likelihood of impasses increases due to negative other-directed emotions, particularly anger (Adam & Brett, 2018; Yip & Schweinsberg, 2017). Thus, as an additional mediation pathway, sleep deprivation should increase the likelihood of impasses through sleep deprivation-induced and intensified anger (Krizan & Hisler, 2019; Short & Louca, 2015).

Taken together, our theoretical analyses suggest that in addition to a reduced quality of negotiation agreements and socio-emotional outcomes, sleep deprivation should also increase the likelihood that no agreement is reached at all. Hence, we state:

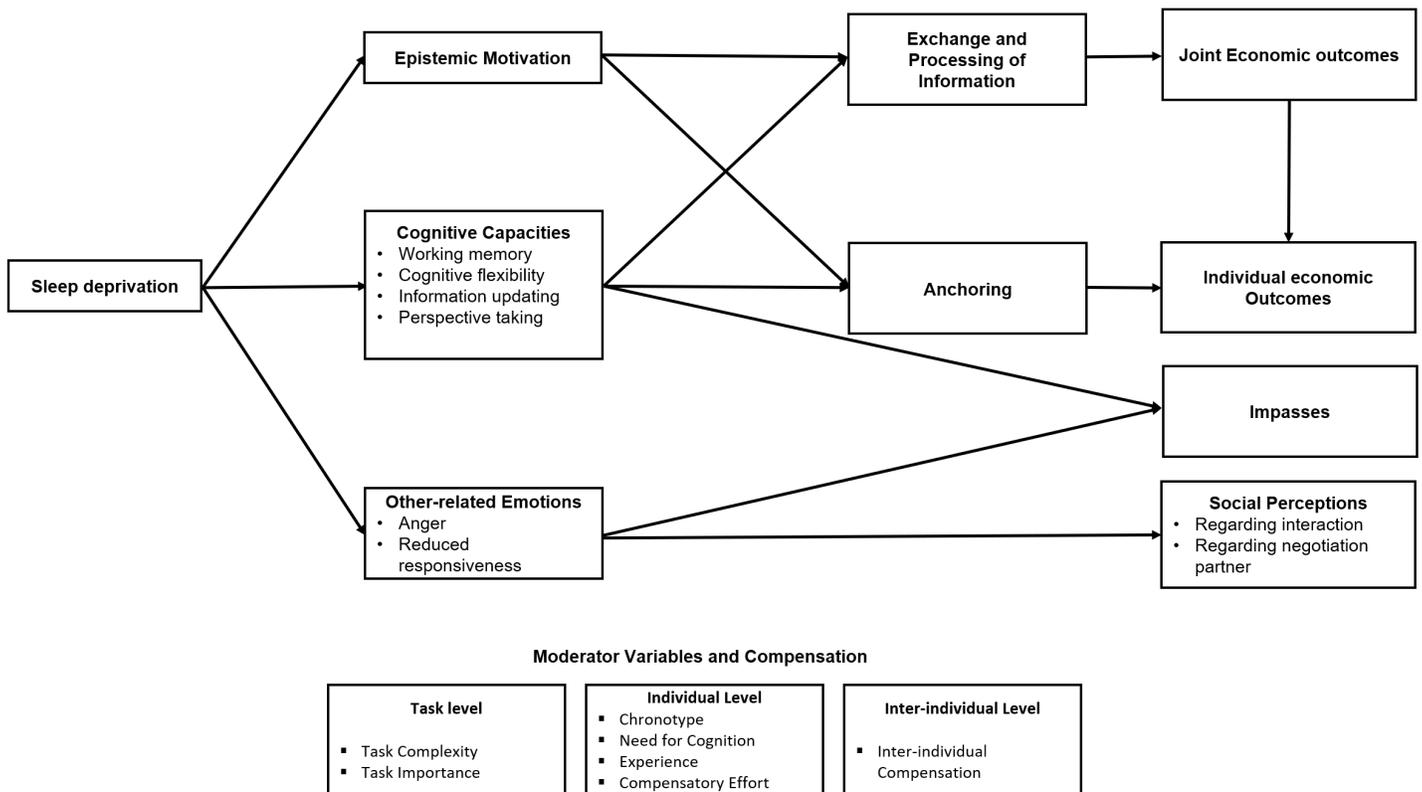
Proposition 4. Sleep deprivation should increase the likelihood of impasses in negotiations.

More specifically, this effect is mediated by a) cognitive flexibility, b) perspective taking, and c) anger.

Discussion

In our theoretical framework we identified three focal mechanisms—cognitive capacities, epistemic motivation, and emotions—through which sleep deprivation should influence negotiation outcomes. Our theoretical analysis has revealed a coherent picture: Sleep deprivation should generate negative effects in negotiations. Specifically, we posit that it decreases joint economic outcomes (and thereby also individual joint outcomes), produces more negative social perceptions, and increases the danger of impasses.

Figure 1
Conceptual Model of Proposed Links Between Sleep Deprivation and Negotiation Processes and Outcomes



Moderators and Compensation of Sleep Deprivation²

Although in general we expect negative effects of sleep deprivation on joint economic outcomes, we acknowledge that the occurrence and extent of these negative effects might not be uniform and robust, but is also a function of specific characteristics of (i) the negotiation task, (ii) the involved individual negotiator(s), and (iii) the interaction between the negotiators. To be clear here, we do not expect any positive effects of sleep deprivation on negotiation outcomes, but identify conditions under which sleep deprivation is *less* likely to produce negative effects, and thus, could be compensated for.

The idea that the negative effects of sleep deprivation on joint negotiation outcomes can be compensated for by different mechanisms is also reflected in the first empirical manuscript on the topic (Halfmann et al., 2022). In two experiments, in which participants performed a dyadic integrative negotiation task either well-rested or after a night of total sleep deprivation, sleep-deprived negotiators did not achieve worse joint outcomes than well-rested negotiators. Moreover, in a third experiment, using a sleep restriction manipulation, sleep-deprived individuals also did not propose inferior agreements after observing a videotaped negotiation. However, in these studies, there was consistent indication of compensatory efforts

² Note that some of the variables conceptualized in our model as a moderator (e.g., task complexity) likely have a direct effect on our proposed mediators (e.g., epistemic motivation), but also on some of the outcomes (e.g., economic outcomes). Although we acknowledge such potential relationships, we refrain from including them in our model for reasons of parsimony, because these relationships should occur independently of sleep deprivation and thus do not inform about our key research question, that is, how negotiation outcomes are influenced by sleep deprivation.

by sleep-deprived negotiators. Furthermore, as a result of a further, qualitative interview study, experienced politicians reported their compensatory strategies to counteract negative effects of sleep deprivation in real-life political negotiations.

Moderators and Potential for Compensation at the Task Level

A task characteristic that potentially moderates the impact of sleep deprivation in negotiations is *task complexity*. With an increasing number of negotiable issues, the potential for integrative bargaining does expand (Geiger & Hüffmeier, 2020), but at the same time a higher number of negotiable issues means that the task becomes more complex and requires more cognitive effort (Geiger & Hüffmeier, 2020; van der Schalk et al., 2010). Generally, and perhaps somewhat contra-intuitively, for tasks outside the negotiation domain, it has been found that the impact of sleep deprivation is typically stronger and more stable in simple compared to more complex tasks (see Harrison & Horne, 2000; Horne, 2012, for a discussion). For example, rather basic cognitive functions (e.g., psychomotor vigilance) are more susceptible to sleep deprivation as compared to higher cognitive functions (e.g., short-term memory; Lim & Dinges, 2010).

One reason for this finding might be that the potential to compensate for deficits induced by sleep deprivation should increase as a function of complexity, as in highly complex tasks outcomes are determined multi-causally and different approaches can be applied to reach an outcome. In contrast, in tasks low in complexity, the potential for compensation is restricted, as outcomes are determined by fewer factors, and the variety in ways to approach the task is limited. Moreover, Harrison and Horne (2000) argue that higher task complexity intrinsically motivates sleep-deprived individuals to show compensatory effort. With such increased efforts, sleep deprivation-related deficits can be counteracted and performance can be maintained over time (e.g., Horne & Pettitt, 1985; Hsieh et al., 2010).

A second characteristic of negotiations that should produce compensatory effort is the *(subjective) importance of the negotiation*. Given the nature of negotiations as a means to solve social conflicts, many negotiations are of high individual importance (e.g., union-employer negotiations). Thus, negotiators should be inclined to perform well and to accept additional effort to optimize negotiation outcomes. We suppose that particularly those negotiations that are carried out under sleep deprivation are typically high-stakes negotiations, with far-reaching consequences for either the negotiators and/or their constituents, further stakeholders, or even the broader public at large (think of, e.g., international political summits, union-employer negotiations, or negotiations during hostage-takings). Even under sleep deprivation, high subjective importance should translate into increased effort to meet the demands of the situation, allowing for compensating sleep deprivation-induced impairments (cf. Deliens et al., 2015, Faber et al., 2017).

Taken together, we argue that if task characteristics allow for and are likely to elicit compensatory effort (as in complex situations or in important negotiations) negative effects of sleep deprivation are likely to be alleviated by active compensatory efforts.

Moderators and Potential for Compensation at the Individual Level

Between-person differences can influence if sleep deprivation unfolds its effects in a negotiation or could be compensated for. Generally, some people are more resilient to sleep deprivation than others. They are more effective in coping with sleep loss (Saksvik et al., 2011). The knowledge on the foundations of these between-person differences in terms of personality and cognitive styles is still sparse (see Horne, 2012, for a discussion), but accumulating evidence has emphasized the role of chronotype as a moderator. Chronotype describes between-person differences in the circadian 24-hour cycle of physiological and psychological functioning (e.g., Horne & Östberg, 1976; Monk et al., 1997). Chronotype is approximately normally distributed, but extreme morning types ('larks') and extreme evening types ('owls') do exist

(Roenneberg et al., 2007). These extreme types show specific wake-sleep patterns (larks: early to bed and early to rise; owls: late to bed and late to rise) and performance peaks over the course of the day (larks: morning; owls: late afternoon/evening). There is also evidence that evening types are better in adjusting to sleep loss and in compensating for the negative effects of sleep deprivation than morning types (Saksvik et al., 2011; Taillard et al., 2011). Hence, we predict that late types are better in compensating for sleep deprivation and should therefore perform better in negotiations under sleep deprivation compared to morning types.

Although there is still a lack of research regarding the role of personality traits in shaping the effects of sleep deprivation, there is preliminary evidence that *need for cognition* may serve as a buffer of negative effects of sleep deprivation. Need for cognition describes a trait characterized by high motivation and enjoyment when performing cognitive tasks (Cacioppo & Petty, 1982; Cacioppo et al., 1996). Kobbeltvedt et al. (2005) argue that individuals high in need for cognition should show more compensatory effort to counteract sleepiness and maintain cognitive performance when being sleep-deprived. In line with this prediction, they found that, when sleep-deprived, cadets scoring high in need for cognition performed better in planning a military operation than cadets low in need for cognition.

In the context of between-person differences, it has also been argued that experience matters when coping with sleep deprivation (Horne, 2012). Hence, in life domains in which high-stakes negotiations under sleep deprivation are common (e.g., in the political arena), the involved negotiators should be better able to compensate for the negative effects of sleep deprivation due to experience and habituation. Even a survival bias is possible: Individuals who are resilient to sleep loss are more likely to arrive at positions where they have to negotiate through the night on a regular basis (Häusser, 2017).

Taken together, individual negotiators can compensate for negative effects of sleep deprivation by taking measures to fight sleepiness or increase effort. Some individuals (i.e., late types, those scoring high in need for cognition, those who are highly experienced) should be more effective in doing so.

Moderators and Potential for Compensation at the Inter-Individual Level

As we discussed earlier, negotiations are interpersonal mixed-motive situations, where the motivation of the individual negotiator is to optimize their individual outcome, while at the same time the negotiators have the collective goal to reach a mutual agreement. In this sense, negotiations show similarity with some tasks, which are often used in studies on group dynamics and performance. In negotiations, the insight that a partial compatibility of interests exists is the key to tapping into the integrative potential and to optimizing joint economic outcomes. Hüffmeier et al. (2019) argue that this task is of a eureka-type, which makes integrative negotiations similar to disjunctive group tasks (cf. Steiner, 1972). Particularly, Hüffmeier et al. (2019) show that an integrative solution in negotiations is sufficiently demonstrable and intuitively plausible for negotiators, as they immediately recognize that this solution would increase the achieved economic outcomes. Hence, due to the sufficient demonstrability (cf. Laughlin & Ellis, 1986) of integrative solutions, it can suffice if one negotiation partner identifies the partial compatibility of interest to unlock the integrative potential (see, however, Zerres et al., 2013).

For the case of negotiations under sleep deprivation, this would mean that compensation on the inter-individual level is possible: Due to the disjunctive nature of integrative negotiations, compensation on the inter-individual level can counteract negative effects of sleep deprivation. Research on group performance under fatigue has shown that groups engage in group monitoring (Frings, 2011), that is, the individual impairments of the group members are monitored by the group and accounted for when working together. Hence, in integrative negotiations, if at least one negotiation partner effectively copes with sleep deprivation, for example, due to compensatory effort or experience, the negative effects of sleep deprivation on joint economic outcomes can be diminished.

Practical Implications

Our theoretical analysis reveals that sleep deprivation has the potential to negatively affect negotiation processes and outcomes in several ways. Although these negative effects can be compensated for, particularly by increased individual or collective effort, there is no good reason to assume that negotiations under sleep deprivation should produce any *better* outcomes as compared to negotiations under well-rested conditions. In other words, the best outcome that should emerge is that no bad consequences occur. That said, the high prevalence of sleep-deprived negotiations in economy, politics, close relationships, or in the labor market appears somewhat disturbing.

Of course, there are situations that are highly critical in time, such as negotiations between conflict parties at the brink of an armed conflict or in hostage-taking situations (see Mertes et al., 2020). However, in other cases, the perceived need to “sit it out” all night and to arrive at an agreement no matter how long it takes is often self-inflicted. A clear-cut practical recommendation based on our analysis would be to refrain from negotiations under sleep deprivation whenever possible.

Our analysis highlights the crucial role of two psychological pathways, namely cognitive capacities and epistemic motivation for negotiations in general and for negotiations under sleep deprivation in particular. Hence, from a practical perspective, it seems to be wise to account for impairments of these two processes whenever our recommendation to refrain from negotiations under sleep deprivation cannot (or will not) be followed. Specifically, we advise creating conditions that allow for compensation of sleep deprivation induced impairments. It has been found that sleep deprived individuals are aware of their sleep deprived impairments (Baranski, 2007) and readily use decision aids to compensate for these impairments (Häusser et al., 2016).

For negotiations, that would mean measures must be taken that support the exchange and processing of information. For example, as cognitive capacities of the negotiators are likely to be decreased, the cognitive load produced by the negotiation task should be reduced. Several decision aids to reduce cognitive load in negotiations have been shown to be effective. For example, providing a negotiation structure with explicit phases of information accumulation and information assessment supports accurate judgements in negotiations (Arunachalam & Dilla, 1995). Additionally, graphical presentations of negotiation-relevant information can reduce cognitive load (see Gettinger & Koeszegi, 2014, for a review). Another effective approach to support the negotiation process is third party mediation as it should compensate for impaired cognitive capacities by promoting the flow of information and supporting uncovering underlying interests (Carnevale & Pruitt, 1992).

Moreover, specific measures can be taken to increase epistemic motivation. For example, introducing higher levels of accountability, reducing environmental noise, or reducing time pressure have been found to increase epistemic motivation in social mixed-motive situations (see De Dreu et al., 2008, for an overview).

Concluding Remarks

In an extensive theoretical analysis, we examined the potential effects of sleep deprivation on negotiation processes and outcomes. Based on our analysis, we conclude that sleep deprivation is likely to have negative effects on joint and individual economic outcomes, socio-emotional outcomes, and impasses. The driving forces behind most negative effects are impairments in cognitive capacities and epistemic motivation. These impairments in turn reduce or bias information processing and hamper effective information exchange necessary to arrive at optimal agreements. Although the expected negative effects

are highly likely to occur, a compensation of these impairments on the task level, the individual level, and the inter-individual level is possible, and thereby negative effects may be reduced or even fully alleviated.

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